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Dr. Jack Ammerman
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September 3, 2009

Dear Dr. Ammerman.

There are, indeed, a number of BU faculty who have articles published in the BTI *Journal of Faith and Science Exchange* to which the BTI holds copyright. This letter confirms permission to digitize those articles written by BU authors for submission to your repository. You also have permission, as you request, to digitize all five volumes of the journal and host it as an open access platform. You will find articles there by other faculty members from additional BTI schools and numbers of their students, many of whom have gone on to do research and advanced work in science and religion areas.

In addition to the repository, I understand that you will be providing a journal publishing platform that will be used to host the journal. As you suggest, at some point we will want to link to this from the BTI web site.

I want to take this opportunity to thank you for providing broad access to the scholarly literature as well as a means of archiving the content in digital form from materials like these – and in this way and in this case to advance the science and religion discussion.

It is our hope to restart this journal, albeit in digital form. We will want to have further conversation when that happens.

Sincerely,



Rodney Petersen
Executive Director

Cc/ Courtland Randall, Marian Simion, and the Trustees of the Boston Theological Institute

PERIOD.

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The Journal of Faith and Science Exchange

Edited by
Barbara Smith-Moran, S. O. Sc.

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Barbara Smith-Moran, S.O.Sc.

with a foreword by
Rodney L. Petersen, Ph.D.

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Editor's Note: As a matter of editorial policy, gender-inclusive language has been used throughout. Scripture quotations have been modified accordingly, but not quotations from other source material.

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Rodney L. Petersen, Executive Director
The Boston Theological Institute

The Boston Theological Institute was founded in 1967-1968 to provide a forum for ecumenical and ethical reflection, and to contribute to the formation of church leaders with a strong ecumenical commitment. It is not separate from its member institutions, but as an independent body seeks to strengthen the schools for their respective missions and tasks. It is to be something of a university of theology, bringing fundamental reflection to the problems besetting persons and culture in the contemporary period. It operates out of the assumption that, in our contemporary cultural period, groups identifying themselves as related to the churches have much in common.

Many of the ethical problems facing the churches and their schools in the founding period of the Institute were primarily sociological in nature. Many of those same issues perdure. Additional questions confront theological education today as our knowledge of the world around us and of ourselves has become more complex. Whether it is to understand better our place in the cosmos, the method for sustaining life on earth in the midst of ecological degradation, or the nature of personhood from early life through to its termination, religion and the sciences are called to carry on a better conversation than has characterized their recent past.

This conversation is not new. Apart from reaching back to the foundations of religious and Christian reflection, schools foundational to the BTI like Harvard University were stamped in their earliest years by a theological quest that was undivided. Leonard Hoar, Harvard College's third president, carried on an epistolary exchange with the eminent chemist Sir Robert Boyle. Hoar illustrates the way in which science was conceived as theological at core by Puritan Divines. The first endowed professorships in the English colonies were the [Thomas] Hollis Professorships of Divinity and then of Mathematics, illustrating how, in the opinion of their Baptist benefactor, God worked through Word and through Nature.

What does science offer religion?

Religion without science lacks substance and the contextual resources with which to understand the world. The word science simply means knowledge. Etienne Bonnot de Condillac, a French Enlightenment philosopher reminds us that science is advanced language. The second task given to Edenic humanity was to name creation. Science is the act of naming the world around us. Scientists are trained to insist on rational explanation and consistent observation so that what is named can be known. It is not the job of science to construct that identity. The world that the scientific endeavor seeks to understand is stubborn, hard, and self-existing world. Scientific understanding grows through careful measurement and disciplined mathematical thought. The knowledge that it yields is usually not exhaustive, but opens new doors of mystery for further inquiry. The twentieth century has shown us that this mystery is as open to manipulation as it is inviting of religious wonder and scientific speculation. In fact, without a common understanding or unified epistemology about nature, the symbols of our worship life become eviscerated and science devolves into technique.

What does religion offer science?

It is often clear enough today why science is important to religion. Less clear is the way in which scientism can define a

worldview and replace religion. For some, of course, this may be appropriate. However, such sentiment often obscures the meaning of religion, its role in shaping understanding, and its function in human societies. A worldview, derivative of religion widely defined, is the formulation we give to a general order of existence. Religious perspectives are elaborated theologically and applied ideologically, but we know more surely today than ever before that those ideas which become central to our lives are not necessarily the religions of inherited social expression. Anything to which we bind our lives may become our religion.

Given this pervasive definition of religion the social problems that we encounter as a society might be reconceived. For example, for some it is not traditional forms of religion but the world of dualistic (Cartesian) science, wed to technology and market expansion, that is the problem behind the failure to deal with patterns of consumption and issues of population. For others, scientism defined as such has contributed to an "economic (European) religion" of the market which distorts the real costs to populations and the environment. This is not to excuse traditional patterns of religious expression from their role in the social problems that we face. However, it is no longer possible to scapegoat any one domain of human activity in the face of deepening environmental problems or as we begin to encounter the difficult issues surrounding cloning, genetics, health care, or issues raised by artificial intelligence, to name only a few.

Although there were always voices questioning the relationship between science and a narrowing mechanistic positivism through the nineteenth century, European and Anglo-American societies grew to accept its division of facts from values, increasingly practiced from the Enlightenment into the modern period, often for good reason. Writing with David Hume's epistemological skepticism in mind, Immanuel Kant's work and legacy was to put empirical knowledge on a firmer footing--but to the detriment of religious understanding, which was never satisfactory to Kant. Although the "real" God escapes knowledge, as Kant defines God in his *Critique of Pure Reason,* the *idea* of God is valuable for speculative thought in at least three ways. First, the concept of God helps to distinguish between appearances and things-in-themselves. This is the idea of "radical monotheism" often associated with the Protestant theologian, H. Richard Niebuhr, with Judaism, or with Islamic iconoclasm. Second, the idea of God suggests an explanation for the mystery of intuition, a variation on the early modern "God-of-the-gaps" theology so discredited through the nineteenth century. A third function of the idea of God is such as to promote scientific inquiry by offering confidence in the intelligibility and unity of the world.

A deepening conversation

Each of these three areas has fallen subject to hermeneutical and cultural discussion, in part due to the intensifying debate over the nature of rationality. Whether scientism or religious dogma has foisted upon the world a domineering anthropomorphism is not something to be resolved here. What is demanded by the deepening conversation between the sciences and religion is a more nuanced approach to our social problems. Whether religion as such, or a particular religion, can provide this wider vision for engaging ecologically tinged issues may depend on whether a given tradition or religious expression is seen as bearing signs of transcendence (symbolic instrumentalism) or as symbols embedded in religious forms of life (linguistic pragmatism), rationality grounded in a greater mystery. What does seem apparent is that what we acknowledge as foundational will shape our ethics.

The social questions that we face mandate a deeper conversation between science and religion, a conversation that includes at least three observations. First, it is increasingly recognized publicly that the language of facts needs that of values. For example, a coherent ethic for sustainability

requires all the information that the sciences can muster. Yet, as Paul Ehrlich reminds us, above and beyond that technological and legislative changes that are mandated, the most important change that is required is a change in ourselves. That such a dialogue is possible is the result of many startling discoveries about the nature of our world in the twentieth century and comes out of a different intellectual climate in the philosophy of science and the sociology of knowledge since the Second World War.

Second, this change in intellectual climate has made for a more equal relationship between science and religion in the Academy. New departments of religious studies have developed across the land, adding to the many divinity schools, schools of theology, and seminaries that have been a part of this country's inheritance. This relationship is not merely based upon a deepening interest in the academic pursuit of religion, its bio-anthropological, sociological, as well as historical development, but is matched by discoveries in the sciences which discern in history, rather than in the laws of determinacy, a more basic perspective by which to understand cosmology, the origin of particles and their transformation into the molecular structures with which we are so familiar, and the plenteous forms of life itself. History rather than determinacy provides the "gate" for increased traffic between science and religion, notes theologian Ted Peters, adding that this is a space in which both theologians and practitioners of the new sciences are at home.

A third observation that might be made about the conversation between science and religion is that this "groundedness" in history implies a value placed upon human activity. It also evokes the question of how a Creator, and perhaps humanity as well, participate in the management of nature. Theologian Wolfhart Pannenberg implies by the providential activity wherein God aims to accomplish God's tasks, not a *telos* or entelechy, but that nature itself is to find its own fulfillment. This idea relates to a point raised by the Australian biologist Charles Birch, who, drawing from Alfred North Whitehead, finds in process theology the conceptual tools for a theology of nature. However, governance may also imply resistance. This reminds us that in the theologies of a number of different religious traditions, creation is not an extension or emanation of God: it is an object of God's love, free to depart from or participate with God's purposes. The arena for this drama is human activity in history. If history is a "gate" through which science and religion meet, we are drawn into an evolving narrative which includes conversation with all peoples of living faith.

Barbara Smith-Moran, S.O.Sc., Director
Center for Faith and Science Exchange

The Student Essay Contest

The time seemed right, in 1997, to present to seminarians and theological students a substantive extracurricular opportunity to think and write innovatively about one of the modes in which science and religion interact: the contribution of the sciences to the "knowledge base" of theology. How might the methodology, worldview, paradigms, and language of the sciences lead fruitfully to progress in learning information about God, the sacred, or the spiritual?

The time seemed right for three reasons. First of all, the Religion and Science Program of The Boston Theological Institute (BTI) has been expanding and maturing, gaining national recognition. Organized in 1990 by the Center for Faith and Science Exchange (FASE), the purpose of the Program has been to create forums in which current and future religious leaders can carry on dialogue with the shapers of the wider techno-scientific culture--the culture where the churches, synagogues and mosques carry on their ministries. Secondly, for three or four years, science-and-religion courses have been offered on a regular basis at BTI schools. Several faculty members of its nine member schools are recipients of Science and Religion Course Awards, given through a vigorous project of the John Templeton Foundation; and students now experience this topic as a regularized part of theological study. And thirdly, by now, the academic landscape worldwide has changed to the degree that it has become possible for BTI graduates to find an advanced study concentration in this area at more than just a few institutions. Concurrently, faculty positions are beginning to open up for specialists.

Given these circumstances, FASE proposed to administer an Essay Contest for all interested students of the BTI. Through a generous grant from the John Templeton Foundation, this first year of the Contest, entitled "Learning More about God: Sources of Information Beyond the Scriptures," solicited essays concerning how the natural, medical, behavioral, and social sciences might contribute to this endeavor.

In not limiting the contest to those currently enrolled in one of the science-and-religion courses, the invitation was extended to others who might be thinking creatively along lines different from the recognized scholarship. This strategy proved to be very successful, as the breadth of themes witnesses.

It was an important aspect of the contest that the schools were not in competition with each other. Each school had the opportunity to produce award-winners in each category. Only at the last stage were the top essays judged against each other for originality of thinking.

The winning essays, published for the first time in this Journal, have passed a two-tier review system: (1) a panel of BTI faculty members and other Boston-area experts picked the finalists from an entry pool of nearly 100 essays; (2) a panel of internationally recognized scholars wrote commentary to each finalist and selected the sixteen Prize winners. Finally, the Reverend Dr. Arthur Peacocke, S.O.Sc., of Oxford University, wrote comments to each of the First Prize winners, and selected from their number the recipient of a Grand Prize.

Progress in theology through the sciences

Theology is often perceived by those outside the field to be resistant to innovation, concerned as it is with eternal truths about eternal subjects. Progress in theology seems to be regarded as a novelty by many who have come to expect frequent reports of progress in other fields, the sciences in particular. Part of this perception is attributable to the news media, of course, which feature daily briefs and features about progress in medicine and the other sciences.

However, theologically trained persons have often found innovative approaches to problems in other fields, including scientific research and application. Likewise, we might expect that men and women trained in disciplines other than theology could bring innovative thinking to that field, as well. The contemporary work of Robert Russell, John Polkinghorne, Paul Davies and Herbert Benson comes to mind, to name just a few of a growing number of such cross-disciplinary scholars.

As most professors will attest, one of their most valuable intellectual resources is a student's ability to stimulate new ideas on a given topic. They have the advantage of not yet being fully trained in the philosophy, discipline, and--importantly--the biases of their field of study. The 3000 seminarians and graduate theology students at the BTI schools represent a pool of fresh thinkers in theology. Some of them have the potential to contribute genuinely innovative thinking to the field, as will be seen in the essays that follow here.

An important fact to recognize when considering progress in religion is its probable non-universality. What is seen to be progress in one tradition ought not be expected to translate as such to other traditions. For this reason, those selected to assay the originality of the submitted essays matched the traditions from which the students were writing.

With this program, we at FASE and the BTI intend to help to "launch," with prize and publication, progressive thinkers and writers into leadership in American religious life.

Creation's Persistent Voice: Critiquing the Secondary Status of Creation as Revelation

Rolf Bouma

Christianity struggles with the concept that nature/creation is truly revelatory of God, and not merely confirmatory of theological conclusions derived from special revelation or deduced from rational reflection. The result is a stilted and narrow conversation between theology and the natural sciences, with the contribution of creation to knowledge of God being limited to certain well-worn paths. If theology is willing to hold a full-fledged conversation with the natural sciences, it may just find that new metaphors and conceptions of God arise that illuminate our understanding of God in ways that scripture alone cannot. Such conversations must be characterized (on both sides) as serious and tentative, with conclusions never considered to be final, but always open to further conversation as new paradigms emerge.

Among the effects left behind at Jonathan Edwards' death in 1758 was a notebook of sketches and illustrations intended for future publication as his theology of creation. Containing a myriad of examples from nature, it represents Edwards' conviction that certain phenomena within creation signify deeper, spiritual realities. A rose with its thorns, for example, signifies that glory only comes through suffering and the cross, while the ways of serpents and spiders with their prey are "lively representations of the Devil's catching our souls by his temptations."[1] Waves in a storm signify God's wrath, while blue skies, green fields, and pleasant flowers figure "the mild attributes of God."[2]

Perry Miller, who edited the notebook for publication in 1948, notes that "[a]t first sight the manuscript seems to be nothing but a catalogue of morals to be read into natural phenomenon by a pious, though to our taste naive, mind."[3] It is, of course, much more than that, standing in a tradition of Puritan use of emblems and allegories, and fitting Edwards' understanding of typology. Edwards' conviction was that certain manifestations within creation were so remarkable and outside the norm that God obviously intended them to be special signs of spiritual truths.

Edwards' intentions display more than naiveté. At a deeper level the implications of his approach are decidedly unsettling. On Edwards' view, one finds manifestations of God and spiritual reality only in abnormal phenomena, not in the normal workings of the created order; and these signs can be linked with spiritual truths only because those truths are known previously by special revelation. In other words, creation itself is not truly revelatory, but only signatory.

Edwards' approach is symptomatic of a larger ambivalence within Christian theology regarding creation as a source of revelation about God. On the one hand, theology holds that creation is laden with meaning and significance as God's handiwork. Theologies of creation tend to push inexorably beyond the Pauline image of God as maker of pedestrian clay pots to a deeper portrait of God as artist. Since a work of art invariably reveals something of its maker, the sense persists that creation, too, must reveal something of its creator.

On the other hand, theology encounters a significant challenge when it begins the task of unmasking the mind of the maker. Creation is no Norman Rockwell portrait. It exhibits angularities and oddities that raise questions about the One who stands behind the Many. There is an understandable fear

of the strangeness of the God that nature reveals, and a suspicion that the image of God refracted through nature's lens may well be a caricature or a distortion. And what of philosophical and scientific theories of nature that shut out the notion of God entirely?

Hence, a significant portion of the Christian tradition places the revelatory status of creation under suspicion, carefully circumscribing its power to reveal. Scripture and creation are acknowledged as two books of revelation, special and general, respectively; but creation is relegated to secondary status. Scripture is canonical; creation is deutero-canonical. Like the apocryphal books, creation is available for edification, but not for establishing doctrine. Creation at best merely confirms what is already present in Scripture. Nature is confirmatory and signatory, not truly revelatory.

As a result, much of the Christian community limits creation to minor, supporting roles in human life and understanding. Creation is suitable to teach children and to induce praise. Parents and educators use a bowdlerized creation to teach children about God's wisdom, ingenuity, and unfailing providence.[4] For adults, a few of creation's many-splendored exhibitions are mined over and over to prove God's power and majesty. Like a poorly planned evangelical worship service in which the praise chorus, "Our God Is an Awesome God," is repeated *ad infinitum* and *ad nauseam*, just a few of the many wonders of creation are harnessed to churn out the same sweet song again and again and again.

Compounding the problem is the fact that significant portions of the Christian community steer clear of the junction between creation and theology. Decades of watching colleagues get caught in the creation/evolution crossfire have added a wariness to the subject, which discourages honest interchange between the natural sciences and theology. Add the prospect of ecclesiastical suicide to the natural feeling of vulnerability that follows from opening oneself up to the contributions of another discipline, and there is little inclination to ponder the scandals of this creation's particularity. Those who do wish to consider nature as well as the Christian faith are tempted to resort to the old dodge of compatibilism with its erroneous claim that religion and science each have their own domain, and can co-exist, so long as each limits itself to addressing the questions appropriate to its domain.[5]

Darwin's theory of natural selection challenged theology to find value in death and the struggle to survive, traditionally disvalued in Christian theology.

Ignored is the fact that science and theology have inevitably had an interchange, with a resulting impact upon theology's understanding of God. The immanently active God of medieval and reformational thought gave way, in the face of scientific conceptualizing, to the wise and consistent God of infinite foresight of Isaac Newton and William Paley. The Darwinian revolution provided a deeper challenge with the abandonment of biological determinism and an open future within the natural order. Darwin's theory of natural selection challenged theology to find value in death and the struggle to survive, traditionally disvalued in Christian theology. The simplicity with which the theory pushed God to the margins, or out of the picture entirely, led to theological uneasiness. Uneasiness in theology and unrest in society encouraged the conversation between theology and science to slow to a trickle. Natural scientists and theologians frequently contented themselves with intra-disciplinary conversation.

Admittedly, these generalizations apply primarily to that branch of Christian theology considered to be conservative and evangelical, and certain movements within

Christian theology (for example, process theology) have consciously and conscientiously pursued rapprochement with the natural sciences . But such tendencies outlined above can be found in the practice, if not in the theology, of almost all segments of the Christian community. It leads one to ask what the result would be if the Christian community allowed creation to be taken out of the children's section and off the secondary reference shelf and moved to a place of genuine engagement. What if the natural sciences were truly allowed a dialogue with theology, and Christian theology were to resist the impulse to cut the conversation short? It would undoubtedly mean some uncomfortableness as the conversation starts, and perhaps a few raised eyebrows and a few winces at observations and comments initially deemed inappropriate and in poor taste. But it would certainly provide lively table talk, and would, in all likelihood, produce unanticipated insights. While the results of an extended conversation between the natural sciences and theology cannot be traced here, perhaps some initial instances can be given of how such a conversation might shape our understanding, metaphorically and otherwise, of God and God's intentions toward this world.

To begin, consider one of the more famous references in the scientific literature to venture into theological terrain: Einstein's famous assertion that "I shall never believe that God plays dice with the world."[6] In context, of course, this is not Einstein's conclusion, but rather an assertion in the face of evidence to the contrary, pointing towards randomness and probability within the natural order. Einstein shared with theological orthodoxy an uneasiness about what indeterminateness meant, regarding the ultimate nature of the physical universe (and for theology, the God who stood behind the universe). The image from which both Einstein and theology drew back was of a non-providential God, of God as compulsive gambler, who jams dollar after dollar into the slot machine and mindlessly pulls the crank of the one-armed bandit.

But is that the image that persists if the conversation is allowed to continue? In other words, is the metaphor apt? True, Einstein's assertion notwithstanding, if contemporary physics and biology shed any light upon the nature of God, it is of a God enamored of stochastic event. But there's method to the madness. Outcomes may not be certain, but tendencies inherent within the system produce jackpots of order and life with uncanny regularity. The probabilities are skewed. If God is a gambler, then it is the sort who gets banned from blackjack tables for counting cards. God plays with a stacked deck and rolls loaded dice. If the conversation between science and theology is allowed to continue without being cut short, the metaphor for God undergoes a subtle shift, from one that repels to one with provocative power.

Or to take another casual comment from the natural sciences, consider the comment of the biologist J. S. B. Haldane, that the sort of Creator nature reveals must possess "an inordinate fondness for beetles."[7] This tongue-in-cheek retort to a half-serious question from a theologian (at least so the story goes) contains the germ of a fascinating conversation between biology and theology. What of the fact that there are somewhere between ten million and forty million species of living things, of which fully a quarter of all known species are beetle variants? Biology tells of a world in which nature's fecundity is only matched by its quest for diversity. If, as Annie Dillard puts it, "[n]ature will try anything once," what does that say of the God who stands behind it all?[8] If the conversation is allowed to continue, there would be ample room to explore the ideas of fecundity and biodiversity, as well as of the place and importance of humanity in the cosmos. If theology had taken such conversation seriously, it may have avoided at an earlier date the anthropocentric hubris that is now increasingly recognized as reprehensible. Instead, statements continue to emerge in line with the sentiments of the Second Vatican Council, that "[a]ccording to the almost unanimous opinion of believers and

unbelievers alike, all things on earth should be related to man as their center and crown."[9] This little bit of Aristotelian nonsense has produced much grief and little grace for the created order. Perhaps humans are crown, but certainly not center. As James Gustafson suggests, anthropocentrism in theology must give way to a theocentrism that allows all the disciplines to participate in the conversation.[10] A healthy encounter with the "otherness" of creation, as well as openness to the contributions of other disciplines, prompts the sort of questioning that moves humans off center and toward a more inclusive worldview.

Conversation such as these have so many interesting angles to explore. What if Biblical theologians were allowed to speak their piece about the God who, in mythic terms, conquers chaos? The Old Testament speaks of the God who splits the chaotic waters to call forth the world,[11] who splits the Red Sea waters to call forth the people of Israel,[12] who erects gates and bars to keep chaos from returning, even when human disobedience threatens to allow chaos to return.[13] The New Testament reveals a Jesus who stills the chaotic winds and waves, and returns the demons to their proper abode in the chaotic Abyss.[14] Chaos is a principle of disorder and dissolution. Then let the natural sciences speak of the emerging concept of chaos within its field--a chaos not to be overcome, but one that names an organizing pattern that in-forms the structures of physical reality.[15] This chaos borders on the oxymoronic, being described at one and the same time as unpredictability and determinedness. It stretches the relationship of notions of order and disorder, of randomness and predictability. The biblical etching of God doing battle with "chaos"--a principle of disorder--is brought into deeper relief in dialogue with modern science's exploration of "chaos"--a principle of subtle order. God, it seems, conquers chaos with God's own variant of chaos. God patterns the universe in unpredictable fashion.

Conversations such as these can take place, however, only if the participants are willing to continue conversing even should discussions take an uncomfortable turn. In particular, conclusions that are either dismissive of other conversation partners or that are rendered with finality, closing off further interchange, bring the conversation grinding to a halt. The nature of scientific theory as open to correction and reformulation must be matched by a willingness on the part of theology to keep lines of inquiry open.

If one were to characterize this sort of conversation, it would best be described as both serious and tentative. Stakes are high. Discussion has implications for our conceptions of God, the world, and the place of humanity in relation to each. It is not a conversation to be taken lightly. Participants need also agree, however, that renderings can be no more than tentative, constantly open to correction and further input.

Deviation from these guidelines in the past has led participants from both sides to leave the table and proceed to carry on their own intra-disciplinary monologues. While carrying on these discussions, the respective sides have eavesdropped on the other, listening for some word or phrase that indicates an opportunity to restart the conversation, but, again, on their own terms. Such a point seems to have been reached in recent years with a new period of interchange between biology and theology. The emergence within the past year of the concept of "irreducible complexity," with its promise of a powerful critique of Darwinian evolution as an all-encompassing theory

Fears that dialogue with the natural sciences will irretrievably alter understandings of God need to be countered with the remembrance that exploration of ideas is not the same as commitment to those ideas.

accounting for all variations of life forms, has again piqued interest.[16] Once again, it is intellectually civilized to posit a God of design. What is unseemly is the rush to the table with a readiness to talk, now that it seems like there may be an opening to discuss nature on theologian's terms.

The danger is that those joining the conversation will continue the tendency in theology to treat nature as confirmatory and not revelatory, as a means of saying "I told you so," rather than listening to what the natural sciences are saying (the science of biochemistry in the case of irreducible complexity) and attempting to discern the impact this new debate has upon conceptions of God and the world. New discoveries almost inevitably lead to altered conceptions, which subtly change our understandings of divinity. Fears that dialogue with the natural sciences will irretrievably alter understandings of God need to be countered with the remembrance that exploration of ideas is not the same as commitment to those ideas, nor is opening up conversation with the natural sciences the same as allowing the sciences univocally to set the agenda for discussion.

At its most basic, this means that theology in its various traditions must be willing to let creation be moved from secondary status on the reference shelf and from its circumscribed role in Christian thought and life, and to become a full partner in pointing towards the God whose glory creation proclaims. In other words, let creation reveal, not merely confirm. Otherwise the Christian community lingers with a theology of creation, like that of Jonathan Edwards, that is moralistic and naive, and can at most point toward God without making substantial contributions to our knowledge of the Divine.

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Endnotes:

[1]Edwards, p. 45.

[2]*Ibid.*, p. 49.

[3]*Ibid.*, p. 3

[4]In her book, *Pilgrim at Tinker Creek*, Annie Dillard uses the name "the devil's tithe" to refer to the ten percent of all species that engage in parasitism. She then sugests that "we give our infants the wron idea about thier fellow creatures in world. Teddy bers whould come with tiny stuffed bear-live; ten percent of all baby bibs and rattles sold should be adorned with colorful

blowflies, maggots, and screw-worms" (p. 233). The idea certainly provides an alternative to the saccharine versions of nature typically dispensed.

[5]For an example of a recent atempt at compatibilism, see Van Till..

[6]Clark, p. 340. This rendition is actually a paraphrase of remarks made in letters from Einstein to Max Born and James Franck.

[7]For a recounting of the event, see Quammen, p. xiii.

[8]Annie Dillard's capacity for observation of and reflection on nature and its meaning for theology is well documented, particularly in her work *Pilgrim at Tinker Creek.* Her skill at asking the right questions in the right places has led Eugene Peterson to recommend her as the pre-eminent "exegete of creation" (see Peterson, p. 77). Dillard's literary approach allows her to mediate between the natural sciences and theology without being accused of favoritism. Literary skill allows her to explore metaphors and conceptions that are unnerving but provocative. For instance, at one point, she refers to God as a "deranged manic-depressive with limitless capital," and asserts that creation "is one lunatic fringe." Insect are "an assault on all human value, all hope of a reasonable god," and the dynamics of natural selection lead her to conclude that it is "a hell of a way to run...a universe." Dillard's saving grace is that she is willing to follow the conversation through to the end, and to allow tension to remain alongside resolution. Those who stay with her to the end come to appreciate in doxological fashion the mystery of encunter with God through creation.

[9]Abbott, p. 210.

[10]See Gustafson.

[11]Genesis 1:1-2; Psalm 104:7-9.

[12]Isaiah 51:9-10.

[13]Jeremiah 4:22-28.

[14]Mark 4:35-5:20; Luke 8:26-39.

[15]For a description of the emerging concept of chaos within science, see Gleick, Stewart.

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All Things Reconciled: A Dialogue with the Sciences from a Reformed Perspective

Gregory W. Carmer

In this essay, the author examines some of the troubled interactions between science and religion in the West, attributing part of the trouble to a reliance upon anthropomorphic models of God and to an illusion of human separateness from the rest of creation. Citing recent findings of biology, neuroscience, and cognitive science, he argues that the human species is religious by its very nature.

Introduction

> When I consider your heavens, the work of your fingers,
> the moon and the stars, which you have set in place,
> what are human beings that you are mindful of them,
> mortals that you care for them?
> Yet you have…crowned them with glory and honor.
>
> --Psalm 8:3-5

The psalmist's question springs from a sense of wonder, occasioned by contemplation of the starry fields in their vastness and beauty. An answer is woven from the threads of God's majesty, the puzzle of human existence, and the order of the cosmos. All three elements play upon each other and find their meaning in relation to each other. Likewise, the most satisfying answers we give ourselves about the meaning of human existence flow from our investigation of the world in which we live, and are bracketed by a sense of the mysterious, majestic, otherness of God.

"Nearly all the wisdom we possess," writes John Calvin, "consists of two parts: the knowledge of God and of ourselves. But while joined by many bonds, which one precedes and brings forth the other is not easy to discern."[1] What can we learn about God through scientific exploration of ourselves and the world around us? Surely a methodological approach to increasing our knowledge of God, apart from the study of Scripture, must focus on increasing knowledge of ourselves and our world, for God is not an object among objects nor a cause among causes. Growth in our knowledge of God does not occur as does progress in "normal" science.[2] Rather, our knowledge of God functions more like a theoretical construction, organizing our experience, informing the meaning we find and attribute to human existence, and ordering our relation to the cosmos and to each other.[3] The findings and theories of science can either confirm the adequacy of a religious worldview as an intelligent, coherent, and comprehensive view of ourselves and our world, or can display the weakness of our conception of God to account for all phenomena.

A view from the Reformed tradition

Four themes recurrent in the Reformed tradition shape my perspectives and inform my disposition towards the sciences: God's otherness, human creatureliness, life's religiousness, and a desire to relate all things to a unifying reference.[4,5] I propose that anyone, working from a perspective informed by these four themes, may benefit from, and dialogue with, other scientific disciplines in several ways. I argue that the findings and perspectives of the physical and human sciences can enrich the meaning of the first three themes by correcting the too-often closed and limited understanding of the nature of God, confirm convictions about the wonders and limits of creaturely

existence, and corroborate the irreformably religious character of all human acts of meaning-making. The fourth theme, that of a unifying vision, I believe, dictates a disposition of openness, humility and wonder.

a. God's otherness

Different thinkers have expressed the otherness of God in various ways. Calvin meditates on the absolutely sovereign Governor who rules all parts of the universe.[6] Edwards savors the sweet glory that appears in all things as expressions of his "great and glorious God"[7] Schleiermacher identifies God as the "Whence" of our existence, upon which we sense ourselves as absolutely dependent.[8] Augustine perhaps best indicates the otherness of God in the following: "We are speaking of God. Is it any wonder that thou dost not comprehend? For if thou dost comprehend, He is not God.... [T]o reach God by the mind in any measure is a great blessedness; but to comprehend Him is altogether impossible."[9]

b. Our creatureliness

As creatures we are aware that we have not called ourselves into being; we belong to something much greater than ourselves, and our existence is intertwined with the fabric of the natural order. Our creatureliness speaks to the relative significance of our existence and to the limited perspective of our understanding. This limits our ability to know God. It also limits our knowledge of ourselves.[10] Augustine cries in his *Confessions*, "I myself cannot grasp the totality of what I am. Is the mind, then, too restricted to compass itself...?"[11]

Yet, our creatureliness also suggests a degree of dignity resulting from the imprint of the Creator's image. It is our status as image-bearers that allows us to comprehend the intelligibility in the world and to respond in gratitude to its Author. That our minds can calculate probability waves of subatomic particles, that we can trace the Universe's history in cosmic radiation, that we can relieve mental anguish through pharmacological therapy, all speak not only of the wonderfully intelligible patterns in nature, but also--and more surprisingly--of our uncanny ability to perceive it. The wonder inspired by the human body and our ability to measure the universe point, in turn, to the character of the Creator. "In regards to the structure of the human body, one must have the greatest keenness in order to weigh its articulation, symmetry, beauty and use," writes Calvin; "but as all acknowledge, the human body shows itself to be a composition so ingenious that its Artificer is rightly judged a wonder worker."[11] As Einstein said, "In every true searcher of nature there is a kind of religious reverence; for he finds it impossible to imagine that he is the first to have thought out the exceedingly delicate threads that connect his perceptions."[12]

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c. Life's religiousness

"He who rejects one religion (or god) can only do so in the name of another," writes Cherbonnier.[12] That humans are irreformably religious is a recurrent theme in the Reformed tradition. Calvin, with all of Augustine's concern for concrete issues, insisted that there is no neutral ground from which to contemplate the meaning of life. Reinhold Niebuhr writes: "Implicit in the human situation of freedom and in man's capacity to transcend himself and his world is his inability to construct a world of meaning without finding a source and key to the structure of meaning which transcends the world beyond his own capacity to transcend it."[15]

d. A unifying vision

A great contribution of the Reformers was their insistence on including all areas of life within the purview of religious concerns. Religion can no longer be viewed as a personal matter of one's supernatural end, super-added to the self-sufficient spheres of science and society. One's religious commitments must inform one's public life. And, likewise, what one encounters in the physical and social worlds must register in one's religious commitments. An absolutely sovereign God assures ultimate harmony among all elements of human existence. Behind this concern is the ancient notion that God is the one author of two great books: Scripture and nature.[6]

The desire for a unifying vision of all human experience suggests several things for theology's dialogue with the sciences. First, we should not hesitate to look closely at the physical world, out of fear of what we may find. Neither should we be too certain in advance of what we might find. The Galileo affair was a lesson in the cost of suppressing acknowledgment of the contingencies of nature in the name of religious preconceptions. Second, growth in our knowledge of ourselves and consequently our knowledge of God, comes through humbly listening, looking, feeling and pondering. And finally, to benefit from our dialogue with nature, we must be willing to feel, as well as to think. Full understanding emerges only when the cool dispassion of controlled investigation is coupled with the drive of curiosity, the wonder of being, the excitement of discovery, and the response of gratitude.

Such a disposition can lead the theologian into fruitful conversation with the sciences, conversation that "trades in intellectually satisfying understanding," as Polkinghorne says, "rather than in logically coercive demonstration."[17] The sciences can offer greater insight, corroborating and possibly correcting theological truths; but they can never fully "prove" religious claims. Likewise, theological truths can enlighten the findings of science, directing us in their application, explicating their significance, and even predicting possible findings.[18] To gain the most from this dialogue, the theologian must move beyond the realm of general epistemological and meta-methodological concerns, and into the consideration of particular, concrete observations.[19] In choosing to utilize conclusions drawn from such dialogues, we should exercise a good deal of parsimony, neither too quickly abandoning elements of the tradition nor too rashly constructing theories on debated issues in science.

Three themes in conversation with the sciences

a. The idolatry of anthropomorphism

Personhood is a central aspect in the Judao-Christian conception of God. God is portrayed in Scripture as one who feels love, friendship, anger, and jealousy; as one who calls, chooses, chastens and engages others. If our concept of God did not include the notion of personhood, we should not be able to engage God as another, as a Thou; we would cease talking of God's love for us and of our affection for God. While personhood seems a formal necessity in our talk of God,[20] it can also lead to the mistake of conceiving God as too much like ourselves. We may affirm notions of the omnipresence of God, but we are unable to imagine a person without temporal and spatial locality. Likewise, the affirmation of the omniscience of God is typically no more than an allegory of human knowing extended without limit. Consequently, the notion of personhood, conjoined with other divine attributes, leads us to imagine that God is a personal agent who attends, intends, desires, knows, purposes, and acts much as we do, but on a much grander scale. What Charles Coulson has labeled the "God of the gaps" is an idol based on a too-human-like notion of God.[21] These anthropomorphic images have led to at least two historic clashes between theology and science, and have eventually yielded either to the recovery of neglected elements in the tradition or to the creation of new models and images of God.

The first instance arose in the cosmological debates of the seventeenth and

eighteenth centuries. Spatial images of a god who literally abides above the Earth in an immutable sphere of perfection and who orders the universe around the theater of human activity contributed to the resistance to accepting the Copernican model of the cosmos. Even after a heliocentric model was widely accepted, such an accomplished scientist and theologian as Sir Isaac Newton could still imagine God as tinkering with the planets and stars, much as a mechanic would fine-tune a clockwork. Such an overly anthropomorphized image of God, as a causal agent manipulating objects, was easily dismissed by Laplace as a superfluous hypothesis.[22]

The second instance arose in the theological responses to Darwin. Scientists and theologians such as Frederick Temple, Asa Gray, B. B. Warfield, Joseph van Dyke, W. B. Pope, and J. McCosh, all found meaning in an evolving universe only through recourse to an image of God as one who plans, plants, purposes, directs, guides, intervenes, and nurtures creation and its growth in ways allegorical to human activity in mechanical or horticultural projects. Those who were best able to accept and assimilate evolutionary theory were those who were able to maintain a view of God as an active creative agent, but without casting their image of the divine in analogies of an inattentive watchmaker or an attentive gardener. Those who could free themselves from the powerful mythical images of God as one who fashions figures from clay and bone were able to integrate evolutionary theory fully within their theology. Aubrey Moore, James Iverach, H. W. Beecher, J. R. Illingsworth,[23] and more recently Pierre Teilhard de Chardin and Charles Hartshorne are such theologians. Teilhard and Hartshorne present novel and progressive notions of the nature of God, while the others, at the prodding of the natural sciences, were perhaps doing no more than recovering lost aspects of the tradition. In an often-neglected passage, Calvin asserts that we may rightly say that "nature is God," if we do so with a reverent mind.[24]

Those who were best able to accept and assimilate evolutionary theory where those who were able to maintain a view of God as an active creative agent, but without casting their image of the divine in analogies of an inattentive watchmaker or an attentive gardener.

b. The illusion of self-possession

If the idolatry of anthropomorphism is the mistake of imagining God as too similar to ourselves, the illusion of self-possession is the mistake of supposing too great a difference between ourselves and the rest of creation. The illusion of self-possession suggests that we are transparent to ourselves, that our desires and behaviors are controlled by rational reflection, that our being and destiny is a matter to be determined by conscious deliberation. Recent theoretical and experimental work in the sciences confirms the limits of our self-knowledge and of our relative significance in the universe.

The illusion of self-possession began to crumble with the post-modern critique of epistemology and science. Contemporary thought in philosophy, science, literary theory, and critical theory suggests that we do not belong to ourselves as much as we belong to traditions, interests, biases and socially constructed and transmitted institutions.[25] Likewise, what we do know as a matter of conscious reflection and focal attention is meaningful only against the backdrop of what is known tacitly.[26] At a fundamental level, the meaning of scientific language--and all other language--is "relational, multiple, and does not necessarily involve conscious categorization."[27]

In a similar vein, recent experimental work in the physiology and psychology of perception suggests that "scientific knowledge [of ourselves and our world] is (1)

limited and relative, (2) social, (3) tacit and dispersed, and (4) contextually constrained and value laden."[28] Neuroscientists tell us that the brain is in some ways "hard wired" to recognize certain sensory input as meaningful, to "make decisions," and to prompt behavior without the input of conscious deliberation.[29] These neurological shortcuts have probably arisen to insure the survival of our species better, but they pay no homage to the self-identified "I" that would exercise sovereign control over the "self." By this account, we are more like cockroaches--whose legs begin to move before the message of perceived danger reaches their brain--than like the masters of the universe of modern mythology. Recent advances in psychopharmacology and neuroscience leave no mistake about the complicity of mind and body; we are a part of nature. On our inability fully to comprehend ourselves, cognitional theorist and naturalist philosopher Colin McGinn seems to repeat St. Augustine, as quoted earlier, when he says, "the brain is an object of perception, laid out in space, containing spatially distributed processes; but consciousness defies explanation in such terms. Consciousness does not seem made up out of smaller spatial processes; yet perception of the brain seems limited to revealing such processes."[30]

But just as we are part of the natural order, we are also unquestionably set apart from it. All the experimenting and theorizing that has lead to the above conclusions also serve as demonstration that we are unique creatures in our ability to ask the questions of who, what, and where we are. Still, as regards our relative significance in the cosmos, geology and astrophysics teach us that human existence comprises an infinitesimal portion of time and space. This does not mean that humans do not hold a unique position in the universe, but it does suggest that the extinction of our species would not much alter the great cosmic scheme. Some have argued from this "objective" view for a style of theological reflection that is truly theocentric rather than self-referenced.[31]

c. *Homo religiosus*

Where Calvin speaks of the religious character of human life in theological terms and Niebuhr explicates the religious dimension in existential and phenomenological categories, a case can also be built for the necessity of religious commitments, using evidence provided by natural history and cognitive science.

Neurophysiologist Rodney Holmes traces the family tree of the genus *Homo* and notes the following:

> The key to the hominid story is that with each major increase in the functional ability of a hominid species, there is a major increase in cranial capacity. Each hominid takes its name from its new proficiency: able tool user, erect explorer, and wise deliberator. The significance of each new ability is understood better in terms of neuroanatomy than in terms of the skeletal anatomy of each hominid. In the details of this story one can see an emergent human character: intelligent, conscious, imaginative and religious.[32]

From these observations, along with insights from linguistics and neuroscience, Holmes concludes that we are "fundamentally a *Homo religiosus*" and that there is "a naturalistic justification for the reality of our interpretation of ourselves as part of ecology."[33] That the emergence of neurological structures responsible for the creation of religious meaning can be identified is not cause to dismiss the objects attended by religious notions, but, rather, argues for accepting the religious picture of Ultimate Reality on the basis of natural history.

Others have traced the meaning-making activities essential for maintaining a unified sense of self and world and for forming the social relationships essential to human life to the normative operations of neural structures.[34] It seems as though the human brain operates in such a way so as to necessitate the formation of "myths"--the cognitive elements of which are set by the environment, and which secure a pattern of valuation and behavior within a social environment. Given the ecological reciprocity of human meaning-making and the environment, J. Ashbrook concludes that "neutrality about life--its purposes and processes--is no

longer an option."[35] Instead, based on the neurological evidence we can affirm that:

> Religion itself reflects humanity's meaning-discerning/meaning-constructing participation in the ecosystem of which it is a part and which it most fully expresses. Sensory processes awaken symbolic processes and, in turn, are shaped by symbolic processes. ...Religion reminds us of God and the soul. It directs our attention to the depth of experience. It seeks the value of what is. It insists upon the relatedness of everything, in a universe that is to be cherished even as it gives birth to *Homo sapiens, Homo religiosus.*[36]

Conclusion

What, then, can we learn about God from the sciences? In addition to a renewed sense of marvel at our creaturely existence in a complex and orderly universe, we can learn with assurance that the posture most appropriate to our species is a religious orientation that unifies our sense of self and world and that spurs us to piety.

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Endnotes:

[1]Calvin, I, p. 35.

[2]Kuhn, chapts. 2-5.

[3]See Kaufman.

[4]I am not claiming fidelity to the theology of Calvin or any other Reformed theologian. Nor do I limit my theological language and categories to those of the tradition. Rather, much as J. Gustafson does in his *Ethics from a Theocentric Perspective*, I have a preference for themes that are evident in a trajectory leading from Augustine through Calvin, Schleiermacher, Edwards, and Reinhold and Richard Niebuhr.

[5]Other theological themes--such as the role of affections in religious experience, the preference for a "salvation history" approach of reading scripture, God's good and faithful provision for human needs--can also be easily brought into conversation with scientific notions. Consider the essential role of emotions in rationality, that perception occurs as things manifest themselves over a length of time, and what some physicists call the "anthropic principle." But the limits of this essay necessitate selectivity.

[6]Calvin, I, p. 200.

[7]Edwards, p. 285.

[8]Schleiermacher, p. 16.

[9]Quoted in Reinhold Niebuhr, pp. 157-58.

[10]Calvin, I, chapt. 1.

[11]Augustine, p. 187.

[12]Calvin, I, p. 53

[13]Quoted in Polkinghorne, p. 30.

[14]Cherbonnier, p. 41.

[15]Niebuhr, vol. I, p. 164.

[16]For a full discussion of the ancient and medieval notion of the unity of nature and Scripture, see Dupré, Otten.

[17]Polkinghorne, "Response," p. 98

[18]In his recent book, *Intersections*, James Gustafson traces several "themes" of interaction between theology and the sciences. Some of these intersections emphasize theology's ability to shape and inform the findings of science and others emphasize science's ability to ground and shape theological concepts while others indicate no real substantial interaction between the two. For a working criterion of genuine integration, see Wolfe, "Introduction."

[19]Gustafson, p. 130 ff.

[20]See Kaufman.

[21]See Coulson.

[22]For a good discussion of the scientific and theological notions surrounding the cosmological debates, see essays by Westman, Shea, Westfall, Jacob, and Hahn.

[23]For a presentation of the thought of these men and those mentioned in the previous sentences, consult Moore, Livingston.

[24]Calvin, I, p. 58.

[25]See, for example, works by Berger, Fish, Gadamer, Habermas, Kuhn, and Popper.

[26]See Polanyi,

[27]Hodges draws his conclusions from the work of psychologists Gibson, Bransford & McCarrell, Michaels & Carello, Neisser and Burke. A similar argument, cast in philosophical language, was used by Carnap in his refutation of Popper's criterion of falsifiability.

[28]Hodges, p. 123.

[29]See Damasio and Tranel; also Hobson, Minsky, Ornstein, Trevarthen.

[30]McGinn, p. 12.

[31]See Gustafson.

[32]Holmes, p. 449.

[33]*Ibid.*, p. 451.

[34]Ashbrook , "The Cry for the Other," p. 96; see also d'Aquili, Trevarthen.

[35]Ashbrook, *The Human Mind*, p. 314.

[36]Ashbrook, "Interfacing Religion," pp. 572-73.

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Is the Search for God Fact(oid) or Fiction?

Forrest Clingerman

This essay opens with an presentation of the postmodern crises of knowledge and method in both the scientific and the theological disciplines. There is potential for science and theology to work through these crises together. To do so, however, a new model of relating them needs to be used. One such model is found in following the discipline of the interdisciplinary.

> The Postmodern period began in the eighties, with the American religious deliriums, in both fundamentalist Christian and New Age forms, and with the indulgence of the imaginary anecdotes of Ronald Reagan and Tawana Brawley; it achieved its apotheosis in O. J. Simpson's acquittal. The salient questions in this new era tend to the epistemological: What do you know, and how do you think you know it?[1]

This quotation comes from a recent article by Kurt Anderson, addressing the factoid nature of the media; but it could just as easily refer to the theological state of affairs of Postmodern America. Instead of the cool assurance of Aquinas or even the liberal theology of the turn of the century, we have, to borrow from the subtitle of Anderson's article, been welcomed to the theological factual free-for-all.

This precarious place of factual uncertainty can be seen in the epistemic crisis that seems to be inherent in any new theological endeavor. Perhaps the greatest contribution to theology in the past twenty years has been David Tracy's work, which has helped otherwise-lost theologians find their way through the mire of a methodological nightmare. In essence, the problem is this: how does theology, which no longer has an unassailable epistemological foundation, reconfigure itself in order fully to comprehend the divine? This is a theological identity crisis of our time.

Part of this identity crisis has come from the postmodern agenda that has been championed for the last few decades. In a rather vitriolic article, Margaret Archer explains the theological allure of postmodernism: "In short, postmodernists denounce modernity which to them is the embodiment of secular scientific rationalism, therefore some theologians feel an elective affinity with opponents of their enemy."[2] If postmodernism, with its post-foundationalist and post-rationalist views, has led innocent theologians into the abyss, it has succeeded in making the "Enlightenment Project" seem at least tenuous, if not downright ludicrous. Theology has become much like a carpenter who spends most of her or his free time fixing the foundation of the house. It may be easier just to build a new foundation, but the problem is that there is a house sitting on top of the cellar hole. The accretions of theological tradition are some of the tools with which we must work, but that tradition is not entirely consistent. Thus, the foundation of our theological structure is in constant need of repair.

Theology is not the only discipline that is currently going through the tremors of uncertainty. In essence, we have become more unsure of the "reality" that science portrays. All the while, science continues to make amazing strides in its predictive ability--which for most of us comes in the form of technology. Public sympathy toward the miracle-working science of the twentieth century is swiftly coming to a close, leaving behind a culture that is not entirely sure of the values of science, while mainlining its technological wares. The

environmental crisis, cloning, and the products of the defense industry are topics in which science has shown its ethical ambivalence--and every day in the living room and in local pubs, new debates emerge. While we may not see science as the best thing since the days of unsliced bread, we certainly see it as giving us an ever-increasing fix of our electronic high. So, novels from William Gibson and Douglas Coupland are filled with the curse and the blessing of our ill-fated love affair with science, from its incomprehensible highs to its crushing, destructive lows.

Theology has become much like a carpenter who spends most of her free time fixing the foundation of her house. It may be easier just to build a new foundation, but the problem is that there is a house sitting on top of the cellar-hole.

Like the crisis of theology, the crisis of science comes from its own making. This does not come strictly from philosophy of science, although the works of recent philosophers have helped. Kuhn and Lakatos are among the most prominent. More influential have been the unique contributions of twentieth-century science, which have helped create the scientific epistemological quagmire. One example that can be quickly pointed out is the dispute over the interpretation of quantum theory.[3] In his book, *Nature, Reality, and the Sacred*, Langdon Gilkey gives us another example. Gilkey writes of an incongruency in many current scientific cosmologies, such as those of Sagan, Hawking, and Pagels. On the one hand, these self-assured authors embody propositions that are "characteristic of an older (in fact, nineteenth-century), now frequently repudiated, 'objectivist' understanding of science, and therefore challenge directly the new understanding of science."[4] This is the same viewpoint that many of the popular media hold of science. On the other hand, many scientists have begun to brush off their college philosophy texts in order to deal with the epistemological problem of the century-old "new science." Gilkey notes this as the realization of the hermeneutical character of science. Gilkey writes, "Nevertheless, from my limited reading of scientific cosmologies, it appears that the word of this breakthrough in the philosophy of science has not reached most of the 'working cosmologists.'"[5] However, this breakthrough has reached others, making certain that science is no longer the island of certainty in a sea of wishy-washy humanities. In fact, science seems to be floating above the sea of reality like the rest of the academic world.[6]

"What do you know, and how do you know it?" Our desire to know God may not come from the latest book on theology--in fact, more often than not, it does not. At the same time, I am sure that more people on the street where I live get their science lessons from watching "The X-Files" on television than from perusing the works of Kuhn, Lakatos, or Einstein. Similarly, much of the academic world has been led down a dark alley that may increase an oversaturated publishing market but does not help in finding the way to a better understanding of God.

As can be surmised from this thought, this paper seeks to examine the theological crisis, although the scientific crisis plays a part in the discussion. Epistemology is reliant on method--thus, an epistemic crisis implicitly leads to a methodological one. It is to this point I would now like to turn.

Methodological crisis

I once saw a sign for a Bible study that read: "Religion and Science: Do you have to leave your brain outside the sanctuary door?" For April Fools' Day, I think I might put this same sign on a lab door, changing the word "sanctuary" to "laboratory." Although this would be amusing, there is some truth to answering "yes" to both questions. In a sense, you do have to leave

your "brain" at the door of both the lab and the sanctuary. The sense in which this is true comes from a facet of our thinking--namely, that ever-ubiquitous "method" that seems to be the bus driver for the Western academic route. Like any bus driver, Mr. Method knows to cut the route up, to stop only at given corners to let people out. If you would like to see something that is not on the route, you have to figure out how to get there. If you only take the bus, you may miss the fluidity of the surroundings. In other words, there is a place between the stop at the supermarket and the one at the bank, but the bus cannot take you there. Our methods determine our outcome. This is something that physics has discovered with wave/particle duality (to mention only one example); it is certainly not exclusive to science, however.

In a more erudite way, Albert Camus made this point in *The Myth of Sisyphus:* "For methods imply metaphysics; unconsciously they disclose conclusions that they often claim not to know yet. Similarly, the last pages of a book are already contained in the first pages. Such a link is inevitable."[7] This point is hardly a revelation in either religion or science. Further, there is a conscious link between epistemology and method; an epistemic goal implies a method. Since the epistemological crisis of our time is becoming more obvious, this also means a concomitant methodological crisis on our worldview. Again, this point is hardly a revelation. However, it is important to understand it, in order to negotiate the ways in which science and religion inform us about the divine. This leads to the crux of this paper. How can religion and science help each other out of the crisis in which they both appear to be embedded? The answer to this question points to the answer to another: How can science lead to information about the divine? This question might be addressed by raising the possibility that it is through a new understanding of "the theology act" that a more cogent method, and thus a more cogent epistemology, will emerge.

A way out of the crisis, together

There is an epistemological crisis, and epistemology is intricately tied to our methodological foundation. Thus far, we have seen that neither science nor religion has necessarily given us a trustworthy basis for finding God, if left to their own devices. The next step that must be taken is finding a new relationship toward theological method that will help in our quest of faith--a relationship that will reassert a methodological foundation. This new relationship, I believe, will have two consequences. First, it will give us a view of science and theology that does not suffer from the same epistemic tremors--in other words, a kinder, gentler theology and science. Second, and perhaps more germane to our final destination, this new relationship will help us understand how science can be beneficial in our theological search for God.

The first step is always the hardest, of course. In order even to attempt a new relationship with theological method, the relationship between theology and God must be clarified, or at least made slightly less murky. What does the gibberish of a theological text have to do with God? Envision two boxers beating each other (much as a student engages Aquinas). When the dust clears and a bloody glove is held up by the referee, victory appears. However, where does victory come from when it enters the situation? How does victory come about?

Theology as a discipline is not properly a large, tree-lined avenue to God. It is, instead, one large question mark (or many different question marks). Theology is a call and a response, and it is only in the response that it gains any recognizable connection with the divine. Certainly, the most obvious example is the case in which God becomes part of liberation theology through Latin American base communities. But if we stop there, we are selling ourselves short. God also becomes part of theology through the act of recognition: as we see ourselves and our world within theological structure, the divine element of theology takes shape.

Properly speaking, theology is not simply the formulating and systematizing, but is the integration of the system into our worldview. Theology's relationship with God is in the potential of a divine resonance within our systematic view of reality, via our action stemming from, and our reaction to, our theology.

This view of theology gives us a lens through which to view the epistemic crisis. After all, if religion is not entirely sure of its foundations, most likely this situation is attributable to a lack of resonance between God and our worldview. That malfunction, in turn, derives from the disintegration of theology's ability fully to evoke the question and response, this divine resonance with our worldview. Of course, any statement like this should be qualified. Some theology does an admirable job; much of the time, though, it does not reach the pulpit and the street corner (unless the corner happens to have a group of seminary students at it). So, the standard "neither the scope or size of the present work" qualification must, unfortunately, be applied here.

However, we are still left enough room to apply this understanding of theology to our present situation. In viewing theology and its problems in this light, as well as seeing that science can not deliver any epistemic certainty to our overall worldview, and assuming that this epistemic crisis is somehow also methodological, then the conclusion that could be drawn is that these fields must be somehow reintegrated. This reintegration would bring the various pieces of the pie back together. When theology is practiced in this way, it not only seeks the divine, but reaches the crossroads of thought and action. To check the score on the argument thus far, it reads: science is necessary to complete the theological act.

Three ineffective models

That science is necessary for theology is not some startling insight; rather, it is an emphasis that should be fostered. Our knowledge of the world is a unitary whole, and theology and science can deliver a portion of that knowledge. However, our relationship with God is not formulated through simplistic academic parceling. Thus, an appreciation of the theological view of a resonance between God and our worldview requires the traditional theological formulations to be transformed by scientific understanding. Since many theological programs attempt to use scientific understanding in theology, it might be beneficial to point out some lines of thought that attempt this connection, and to explain why these lines are not implied in the argument made here. First, consider what might be termed the "awe and wonder factor." Usually this is propounded by those in the scientific community, particularly those who are not aligned with any specific religious tradition. While the "awe and wonder" that occur when a scientist surveys the order and complexity of the universe is indeed awesome and wonderful, this a theological statement does not make. The "awe and wonder factor" is not sufficient to rebuild a theological understanding.

A second line of thought, in which theology is completed by science, is the attempt to show how theology can be considered to be a scientific discipline. An excellent example of this is Nancey Murphy's work, *Theology in an Age of Scientific Reasoning*, in which she seeks to show that theology can be considered as a Lakatosian research program. To say that

While the "awe and wonder" that occur when a scientist surveys the order and complexity of the universe may indeed be awesome and wonderful, this a theological statement does not make.

this is not an acceptable possibility in the current circumstance is not meant as a disparagement of Murphy's work--the clarity and erudition of the volume would make this difficult. But the effort is simply a mixing of apples and oranges. The definition of theology which I would like to present is not determined by the viability of theology as a scientific program. Similarly, the question of whether theology is such a discipline does not rest on the current argument.

Finally, the third line of thought is the segregated-knowledge argument. An example of this can be found in Langdon Gilkey's work, in which he describes the separate forms of scientific and theological knowledge. The problem with this argument is that it confuses differing methods--or maps to knowledge--with the knowledge itself. Assuming that knowledge is a unitary whole, I am suggesting something that contradicts the theory that there are different "types" of knowledge. There is absolutely nothing fundamentally different between the knowledge given by science and that given by theology. Admittedly, each discipline's questions and methods differ, and thus each gives different answers; but each is fundamental for our overall view of reality. In effect, the difference that arises is in the mode of knowing, rather than the knowledge itself.[8]

The interdisciplinary as a new model

If these three possibilities do not encompass what this synthesis of religion and science means, they are still indicators of what it means. In conclusion, the final thrust of the argument is this: that we must rediscover the interdisciplinary as discipline. A synthesis means finding the interdisciplinary as the discipline of seeking the divine. While both science and theology ask questions in their own respective ways, it is only through a "coming together" that the theological act can truly be completed. In many respects, this is already being done. We see the role of our faith when we understand how God's creation is degraded through clear-cutting or strip-mining. We feel the presence of God when we hear the cry of a baby that is born healthy in a modern hospital. We can only pray for the mercy of God when we see that we have built the weapons that kill people thousands of miles away. Each of these examples portrays the theological act in an intuitive way--and each reflects both science and religion. In addition to the theological viewpoints we have, science gives us new ways of viewing the world that are integrated into our knowledge of the divine. As we seek to find a way out of the epistemic maze without meeting up with the Minotaur, we will need to rely on all of our knowledge. Science gives us new ways to act, just as theology does. Through them, the theological act can be completed and the presence of the divine brought among us.

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Endnotes:

[1]Anderson, p. 40.

[2]Archer, p. 405.

[3]Although many writers have tackled this subject in detail, a brief exposition may be found in chapter 2 of Nick Herbert's book, *Quantum Reality: Beyond the New Physics.*

[4]Gilkey, p. 45.

[5]*Ibid.*, p. 44.

[6]For a helpful and brief analysis of current philosophy of science, see Murphy, ch 3.

[7]Camus, p. 9.

[8]This discussion is regrettably brief and deserves a paper unto itself. My thought on the subject has been formed, in part, by my studies in Buddhism, particularly Kitaro Nishida's work, *An Inquiry into the Good.*

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Complexity, Consonance, and the Concept of God

Peter Heltzel

Complexity theory has much explanatory power in the scientific community today. The author finds that its bottom-up methodology and some of its concepts can facilitate new understandings of the Christian doctrine of the Trinity.

You can see a world in a grain of sand
And a heaven in a wildflower.
--William Blake,
"Auguries of Innocence"

The potential of consonant discourses

From the heavens full of galaxies down to the tiniest grains of sand, our world is full of amazing complexity. The enormous progress being made in our understanding of complex phenomena is considered by many scientists to be one of the most impressive features of contemporary science.[1] Nowhere are these gains more evident than in complex systems theory. This research method analyzes the complex interaction in groups of agents that work together to form a cohesive unit, such as an ant colony or human society. How does complexity arise? How can complexity increase our understanding of God? What type of deity would be found in the heaven seen in Blake's wildflower?

Today, complex systems theory can shed significant light upon theology. This essay makes the following arguments: first, that there is a consonance between complex systems theory and theology; and second, that complex systems theory helps to illuminate the Christian concept of the Trinity.

Ernan McMullin uses the term "consonance" to refer to a harmony of sounds or elements between two bodies of knowledge, such as religion and science.[2] Complexity is one such element that unites these two disciplines. Despite the fact that science and religion are different disciplines, with different tasks, categories, and objects of study, they complement each other in many ways. There is consonance between these two discourses that can deepen our understanding of God through a new linguistic synthesis that reflects the complexity of the natural world. To illustrate this consonance, language from complex systems theory can be appropriated to articulate clearly the Christian doctrine of the Trinity, the Divine reality of three Persons united in one essence.

Within the Latin Medieval tradition of analogy, complex systems theory can make a great contribution to the elucidation of the received Christian doctrine of the Trinity. Most of the recent work written on complexity and God has focused on God's activity in the world.[3] As Athanasius pointed out in *Against the Arians*, God's acts (*energeia*) cannot be separated from God's being (*ousia*), although these two are distinct.[4] Many of these authors have neglected to discuss how complexity can be employed in the constructive task of understanding and explaining both the acts and the being of God.

The synthetic articulation of the Trinity at the end of this essay seeks to highlight the complex interaction among the three Persons within the Godhead. This task is taken up with great reverence and trepidation, since the being of God is a mystery. Complex systems theory is applied to doctrinal construction--a human analytic/synthetic explanation of God that does not presume to make univocal claims concerning the mystery of God's essential essence.[5] The Trinity displays complexity in three

primary ways: the double-dimensionality of being both in time and eternity, the establishment of identity through interaction, and the dynamic relations of the three Persons. This essay examines the complexity within the nature of the Trinity, after introducing the contemporary discourses in Trinitarian theology and complex systems theory.

Introduction to complex systems theory

Complexity is a multivalent term used in a wide variety of contemporary discourses. It is a subject so wide-ranging that nobody quite knows how to define it. In a recent article, William Stoeger clusters many topics under the rubric of complexity including dynamical systems, chaos, non-equilibrium thermodynamics and the physics of self-organization and of complex systems.[6] The physics of complex systems refers to the quality of a group of interrelated entities that form a single whole. A complex system provides a forum where many distinct agents are interacting and interdepending on each other in a number of ways. The millions of chemically interacting proteins, lipids, and nucleic acids that make up the brain are an example of a complex system.

The ant colony is another popular model for illustrating a complex system, because while the individual ant can perform only one task at a time, all the ants in the colony can together perform over three dozen tasks concurrently; their aggregate behavior enables the colony to operate almost as a single organism. Scientists analyze such systems from the *bottom up*, observing the behavior and patterns of the individual ants, in order to understand the system as a whole. Systems are often adaptive, so scientists frequently find surprising "emergent behavior," such as clusters of ants dividing labor to perform various tasks.

Contemporary complex systems theory has some of its roots in the general systems theory of the fifties. In his book, *Problems of Life*, Ludwig von Bertalanffy, the father of systems theory, marvels at the "tremendous architecture" of systems in the body from chemical structures to cells, tissues, organs, and multi-cellular organisms.[7] These multi-level systems all hold together in living beings. Systems theorist Ervin Laszlo unifies these natural complex systems in his philosophy of nature as "integrated pluralism," or "an ontology that proclaims both the diversity and unity of the world."[8] Thus, systems in nature are complex, yet unified and simple. This is the central paradoxical insight of complexity theory--unity within complexity.

Today, some of the most innovative work in complex systems theory is being conducted at the Santa Fe Institute. This research center has applied complex systems theory to a variety of disciplines, including computers,[9] physics,[10] anthropology,[11] and biology.[12] Mitchell Waldrop gives an account of the history of the Santa Fe Institute in his book, *Complexity: The Emerging Science at the Edge of Order and Chaos*, which contains one of the most comprehensive explanations of complexity theory to date.[13]

Waldrop argues that the structure, coherence and self-organizing cohesion of complex systems bring order and chaos into a special kind of balance.[14] This balance is achieved at "the edge of chaos," which Waldrop compares to the difference between solids, where the atoms are locked into place--and fluids, where the atoms tumble over one another at random.[15] "The edge of chaos" is the transition stage between the extremes of order and chaos, where complexity is found: "a class of behaviors in which the components of the system never quite lock into place, yet never quite dissolve into turbulence either."[16]

Recovery of trinitarian theology

As the scientific community is coming to a new understanding of complexity, the Christian theological community is at the start of a new recovery of its central doctrine of the Trinity, which some would consider Christianity's most complex concept.[17] Under the tutelage of Augustine and Aquinas, the West has inherited a rich

tradition of Trinitarian theology. Yet, Western theology has not been without problems. The West has tended to emphasize the oneness of God, leading toward a psychological model of the Trinity quite different from the Eastern communitarian model. St. Augustine is often blamed for the Western emphasis on oneness at the expense of the three Persons.[18] Karl Barth's and Karl Rahner's Trinitarian works build on this Augustinian foundation--where God is seen as the one self-conscious subject, in three "modes of being"[19] and "distinct ways of subsisting."[20]

This overemphasis on the unity of the Trinity was not found in the preceding strain of Christian theology in the East.[21] Beginning with the three Persons of the Trinity, the concept of God held by Athanasius and the Cappadocian Fathers was decidedly more communitarian.[22] To start with the three Persons of the Trinity in salvation history and *then* to move towards accounting for the nature of their unity, anticipates the bottom-up research approach of complexity theory. Many contemporary Eastern Orthodox theologians have employed this bottom-up methodology to preserve the communitarian tradition; they include John Zizioulas, who argues that the Trinity is *being in communion*.[23] Community is central to the Christian understanding of God, since it posits Persons who are capable of fellowship. The contemporary recovery of the Trinity among Roman Catholics and Protestants also focuses on a relational and communal model.[24]

Some of these Christian theologians have begun to discuss God in light of contemporary science. Thomas Torrance has led the way in this integrative approach to Christian theology.[25] More recently, during the summer of 1993, a cross-disciplinary group of twenty scholars and scientists met at the Center for Theology and the Natural Sciences in Berkeley, California. Together they explored the implications of chaos and complexity theory for philosophical and theological understandings of God's action in the world.[26]

One of the theologians in this group, Denis Edwards, wrote an important article, entitled "The Discovery of Chaos and the Retrieval of the Trinity," in which he argues that the universe is God's self-expression, and that there are "proper" roles in creation for each Person of the Trinity.[27] Edwards' article is characteristic of most of the recent literature in religion and science today, with its concern for God's activity in the world. Complex systems theory can also illuminate the Triune *nature* of God.

God's nature in light of systems theory

If it is true that the God created the world, it would seem that God's "invisible nature" would be mirrored in some ways in the creation, both in humanity, which bears the *imago Dei,* and in nature, which also bears the Divine imprint.[28] Applying analogies from the natural world to the concept of God is a profitable way to deepen our understanding of God; however, there is no perfect analogy for God. The world is a mirror of God, but God is not a mirror of the world. Furthermore, the world is an imperfect mirror of God, because of sin and the fall of humanity.

At the core of complexity is the conviction that complex systems share similar behavior; so, what is learned from one system can be applied to another.

Analogies show similarity in difference. There is a fundamental difference between natural systems and the Christian God--namely the difference between created and uncreated, material and immaterial reality. As Thomas Aquinas said in the thirteen century, "no term can be used of God in quite the same sense [*univoce*] as it is of other things."[29]

Analogies are limited, but beneficial, in understanding God. They are windows to an unfamiliar world. Analogies simply suggest, but do not exhaust, what they indicate.[30] This suggestion requires a consonance, which allows a harmonious chord to strike when an analogy is appropriate. Although God is clearly not a complex system, using insights from the concept analogically helps us to understand the Triune nature. The Western Medieval tradition was congenial to the use of analogy in theology.

The Medievals saw the world as sacramental and full of hidden meaning. They conceived of the natural world as a set of concentric spheres. Complex systems theory fits easily into this framework. At the core of complexity is the conviction that complex systems share similar behavior; so, what is learned from one system can be applied to another. Dynamic patterns that scientists see in an ant colony can be applied to human community and even to the New York Stock Exchange. Analogies are a key to understanding the interconnectedness within such complex systems. Analogical thinking helps us understand the complexity of the Triune God.

Levels of complexity to God's nature

Theologian Gordon Kaufman points out that the meaning of the *concept* of "God" is itself extremely complex.[31] Varying degrees of complexity are found in all traditional conceptions of God in the world's religions. For example, the Hindu concept of God is much more multifarious than the Christian concept; and all the personal deities of Hinduism are considered as manifestations of one underlying divinity or unity. The Christian concept of a Trinity shows complexity in three primary ways: the double-dimensionality of being both in time and in eternity, the establishment of identity through interaction, and dynamic relations among the Persons.

The Trinity makes it clear that God is active both in the world and in the Godhead. Through the incarnation, God entered into space and time.[32] "Incarnation" is the term for the entry of the Son, the second Person of the Trinity, into the natural world.[33] This is the most obvious starting point for the Trinitarian revelation of God. "How can an infinite God enter into finite time?" was a question that plagued many Jewish and Muslim philosophers, including Philo, Averroes, and Maimonides. They were skeptical of the incarnation, because it would necessitate the complex double-dimensionality between the Godhead and the Son.[34] The Son, the second Person of the Trinity, entered fully into time, illustrating the way in which all of the Persons of the Trinity are involved in the world from its creation to its consummation.

The Christian concept of a Trinity shows complexity in three primary ways: the double-dimensionality of being both in time and in eternity, the establishment of identity through interaction, and dynamic relations among the Persons.

Even though the Son entered time, according to Christian theology, he was still one with the Godhead. Particularly illustrative are the statements of ontological unity in the Gospel of John.[35] For example, Jesus said, "I and the Father are one."[36] Through such statements, we see the intimacy and unity between the Father and Son, although they are distinct Persons and have different roles in redemptive history. The Father and Son are *distinct, but not separate*, because they are one communion, working together.[37] Father and Son work together in different ways to redeem the world. The Father has the role of sender while the Son is sent into the world, to be crucified for the sins of humanity. The Father's and the Son's cooperative yet distinct roles in redemption make clear the personal interaction and interdependence of these two

distinct Persons, united with the Holy Spirit in one Godhead. The ants that work together in a colony, for their own self-preservation, model in a small way the Persons of the Trinity, who work together to redeem the world.

The presence and activity of the Holy Spirit in the Trinity intensifies the complexity within the Godhead. The Holy Spirit, traditionally referred to as the third Person, is also revealed and implied in the acts and interactions of the Father and Son.[38] For example, the Holy Spirit plays many important roles in the life of Jesus--as the agent of the virgin birth of Jesus, the one who inspires his earthly life and the enabler of his works, death, and resurrection. As with the Father and the Son, the Holy Spirit's Triune identity comes through mutual interaction and relations in the shared activities of the Godhead. The Spirit is the Spirit by virtue of its interaction with the Father and the Son. The relations are constitutive of each Person's identity.

The Holy Spirit, as third Person of the Trinity, has an essential place in the Triune communion, because it is the presence of a third Person, regardless of which one, who ushers in the complexity. The three-body problem from astrophysics will illustrate this point. When two planets are in orbit, astronomers have no problem predicting their coordinates. However, when a third planet is added, the conditions become infinitely more complex. Because of the mutual perturbations of the three, there is no longer a closed solution for the equation. Although the parallel between the three planets and Persons of the Trinity is accidental, the fact remains that the Holy Spirit ushers an infinite amount of complexity into the Triune communion.

The Trinity displays complexity through the establishment of identity through interactions, and through the double-dimensionality of being in both time and eternity. This complexity reaches its zenith in the perichoretic relations between the three Persons. "Perichoresis" is the traditional term that describes this mutual containment, interpenetration and indwelling of the three Persons. Not only are there three Persons, displaying an infinite complexity, but these Persons wholly dwell within one another. This interpenetration is the height of complex interaction. The paradox is that, though each of the three distinct Persons mutually in-dwell, they are still three Persons united in one essence. While there is complexity in the Christian Trinity, God is also simple in very nature.[39] Thus, the paradoxical insight of complexity theory--simplicity in complexity--is present in the Triune conception of God.

In order to redeem the world, the Son entered into time, displaying a complex, double-dimensionality within the Trinity, of being simultaneously in time and in eternity. Although Jesus was in time, he was not separated from the Father and the Spirit, because it is through their complex mutual interactions that their respective identities are found. The perichoretic relations among the three are the highest expression of the inner complexity present in the Trinity. Complexity is ordered into a beautiful unity in the concept of the Trinity. This appropriation of the language of complexity theory into the doctrinal construction of the Christian concept of God is only the beginning. Other religious perspectives should be incorporated into the modern discourse on complexity.

Clearly, a consonance may be found between complex systems theory and religion. As an example of how to work dialogically between these two disciplines, complex systems theory may be applied to concepts of God. The bottom-up methodology of complex systems theory is a further example of consonance between these fields and holds much promise for contemporary theological method.

The discourse of complexity theory is especially suited for clear theological articulation. Not only Christians, but theologians from all religious traditions, can use findings from complexity theory for a fresh articulation of their concepts of God. The complexity theorists can also benefit from dialogue with these faith traditions, to understand the deeper spiritual aspects of

complex natural phenomena. From a grain of sand on the beach to the little children building sand castles, complexity in our world points to the multitudes of galaxies in the heavens and beyond. Not only can we see a world in a grain of sand, but we can ascend to heaven in our viewing of a wildflower.

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Endnotes:

[1]Kuppers, p. 93.

[2]See McMullin.

[3]See Russell, Murphy, and Isham; Johnson; Polkinghorne.

[4]Athanasius, 2.2, 2.28, 3,65.

[5]Barth, pp. 179 ff; pp. 297 ff.

[6]Stoeger, p. 183.

[7]von Bertalanffy, p. 23.

[8]Laszlo, p. 47.

[9]See Zurek.

[10]See Gell-Mann.

[11]See Johnson.

[12]See Kauffman.

[13]See Waldrop.

[14]*Ibid.*, p. 12.

[15]*Ibid.*, p. 237.

[16]*Ibid.*, p. 239.

[17]Edwards, p. 157.

[18]See Gunton; Augustine, 5.7, 8.11, 9.12, 10.3.

[19]Barth, pp. 479 ff.

[20]Rahner, pp. 110 ff.

[21]See Martland.

[22]Basil of Caesarea, pp. 42 ff; Gregory of Nazianzen, pp. 217 ff.

[23]See Zizioulas.

[24]See Moltmann; LaCugna; Bracken; Gunton; Peters, *God As Trinity*; Torrance, *The Christian Doctrine of God.*

[25]See Torrance, "God and the Contingent World."

[26]See Russell, Murphy, and Peacocke.

[27]See Edwards.

[28]Romans 1:20; Augustine, 11:8.

[29]Aquinas, I/32:143.

[30]Torrance, *Reality and Scientific Theology*, p. 202.

[31]Kaufman, p. 14.

[32]See Torrance, *Space-Time and Incarnation.*

[33]John 1:14.

[34]Peters, "The Trinity In and Beyond Time," p. 263.

[35]John 8:58, 16:25.

[36]John 10:30.

[37]Oliver, p. 399.

[38]Dragas, pp. 44 ff.

[39]Athanasius 4:1.

The author dedicates this essay to his former teacher at Wheaton College (Illinois), Professor Mark Noll.

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Cosmic Evolution and the Theology of Social Solidarity

John Newton Hewitt

This essay is concerned with the intersection between theology, social theory, and evolution. In an effort to sketch an ecologically sound theology of social solidarity and a global ethics, the author examines constructive theologies that take cosmic evolution as a central organizing principle. While the inherent utopianism of Washington Gladden's social gospel cannot be revived, his theology provides useful insights into the creative use of scientific and religious discourse for a contemporary democratic theology in search of the common good.

Introduction

> The great development of the natural sciences and the rise of evolutionary theories have also had their effect upon Christian theology. That there are vast numbers of protestant Christians who have been scarcely touched by these influences is true; but these influences are shaping the thought of the world, and it is impossible that the theology of a living Church should not be profoundly affected by them. For natural science is simply telling us what God is doing in His world, and evolution is simply explaining the way in which His work is done. At bottom, all this is religious truth, of the most fundamental character; and, if Christian theology is true theology, it must include the truths of science and evolution.
>
> --Washington Gladden[1]

For more than a century now, there has been a consensus about evolution among the leading scientists and theologians. Indeed, an increasing number of prominent thinkers have professional qualifications both as scientists and theologians.[2] If one includes the work of a scientist and natural philosopher such as Paul Davies (a winner of the Templeton Prize), who is extremely interested in questions of a religious nature--bearing in mind that his books sell by the proverbial truckload--then it is clear that there is a serious desire among educated people to find a vision for life that is at once spiritually edifying and intellectually sound. There may be some ruffling of the feathers at the margins of scientific and theological discourse--I speak of the "scientific creationists"[3]--but most people concur with Arthur Peacocke's assertion that, "after two centuries or more of bickering, or of sullen silence with demarcation of spheres of interest, these two fundamental activities, the search for intelligibility and the search for meaning, that characterize respectively, but not exclusively, science and religion, find themselves inextricably interlocked with each other in the common human enterprise of seeking *both* intelligibility *and* meaning."[4]

A very clear example of what Peacocke is suggesting is provided in the work of astrophysicist Eric Chaisson. Chaisson defines cosmic evolution as "the study of change through time."[5] Over the course of time, this process of change has brought forth all the features of the physical universe, and the emergence of life itself. Cosmic evolution thus includes biological evolution as a subset of the whole. Chaisson holds that "cosmic evolution is an attempt to build a cosmology in which *life* plays an integral role. It is an attempt to frame a heritage--a cosmic heritage--a sweeping structure of understanding based on events of the past (for as we look out in space we probe back in time), an intellectual road map identified and embraced by humans of the present, indeed a virtual blueprint for survival if adopted by our descendants of the future."[6] According to this description, Chaisson's "scientific philosophy" clearly brings him into the ambit of theological exploration.

Indeed, the key point for the purpose of this essay--and one certainly of central importance for contemporary theology--is that with the emergence of the higher forms of life, and in particular the rise of consciousness, the very process of cosmic evolution is given a *creative direction*. This is a theme that Chaisson expands on in his book, *The Life Era: Cosmic Selection and Conscious Evolution*. Peacocke puts this idea into a somewhat more traditional theological form:

> It is as if man has the possibility of acting as a participant in creation, as it were the leader of the orchestra of creation in the performance which is God's continuing composition. In other words man now has, at his present stage of intellectual, cultural, and social evolution, the opportunity of consciously becoming *co-creator* and *co-worker* with God in his work on Earth, and perhaps even a little beyond Earth. To ask how to fulfil this role without the *hubris* that entails the downfall classically brought upon those who 'would be as gods' is but to pose in dramatic fashion the whole ecological problem. But at least one who sees his role as that of *co*-creator and *co*-worker with God might have a reasonable hope of avoiding this nemesis, by virtue of his recognition of his role *ipso facto* as auxiliary and co-operative rather than as dominating and exploitative.[7]

This is an exciting idea, not just because it offers a potential synthesis of scientific and theological concepts, but also because it provides the grounds for a truly global ethics--one in which two features impress themselves upon us: (1) the interdependency of all living things in the biosphere (the web of life), and (2) the responsibility that humans have towards the future direction of evolution within the biosphere (and possibly beyond). We will shortly discuss this point in more detail in relation to the work of Daly and Cobb. Of course, theologians will rightly interject that such a vision might engender the kind of *hubris* to which Peacocke alludes. Certainly, there is a danger of idolatry--humankind will not just become *like* God, but will act *as* God in the scheme of things. Interestingly enough, this universal human temptation was alluded to in the Hebrew creation stories. We are warned by the wisdom of the sages.

Nevertheless, the arrow of time in the process of cosmic evolution cannot be reversed. Humans are indeed in a unique position, and undoubtedly hold a privileged position as the species that possesses not only consciousness (and the ability for reflexive and creative thought), but the ability to redirect the very process of evolution itself. For this reason, evolution has never been more central to the task of theology, and theology has never been more important as a means of interpreting this stage in the unfolding of a cosmic purpose. One cannot put it any more succinctly than Gordon Kaufman has:

> [H]umans have a power of creativity, a power to transform their inherited conditions of existence, which is unique among all living beings of which we know. Humans have produced a whole new order of reality--culture, the symbolic world, the order of meaning--which they have superimposed on the natural order into which they were born, and they have made this artificial world their home. Of course, all living beings are able to process information, and animals are able to communicate with one another and to rearrange their natural environment so that it will be more suitable to sustain them (by building nests, storing food, and the like). Humans, however, have gone far beyond all others in constructing an entire artificial world which does much more than simply meet their biological needs: it introduces a wholly new realm of being, the symbolic order, the order of meaning (what we shall later call the order of 'spirit'), and this has in turn generated in men and women new desires, interests, and needs which go far beyond strict biological utility, and sometimes even contradict it.[8]

As already intimated, the theological enterprise (in Kaufman's "order of spirit") has never been more important as a means of navigating into the future.[9] Our realization of this fact has been brought on by a growing sense of a looming ecological crisis, the result of our technological development. But even more than this, humankind is threatened by a fundamental spiritual and ethical crisis (not necessarily related to increasing secularization--as this has often been liberating--but owing to the rise of egoism and materialistic values). As Chaisson says:

> It is important to realize that the problems we face today are not similar, not even in principle, to those of previous generations. The recent exponential rise in technological achievements and the inability of society to cope with them have led to problems basically different from those confronting earlier civilizations.... We are in a transition period that no Earth society ever has encountered. This is not a doomsday forecast but a statement that social and political organizations appear unprepared to deal with the widespread changes necessary for our continued existence.[10]

Chaisson continues to provide a sketch of a solution to this crisis in the "life era."[11] It has now become imperative that human beings develop a "global culture" and a "planetary ethics."[12] This ethics must of necessity be able to apply to all of humanity and be flexible enough to fit the process of change itself. He doubts whether philosophy, religion, and even science (given its specializations) can effectively carry out this task, owing to the pluralistic nature of our societies. No single religious tradition would be able to generate a sufficiently global ethics.

However, Chaisson turns to evolution itself as the source of this planetary ethics.

Humans hold a privileged position as the species that possesses the ability to redirect the very process of evolution itself. For this reason, evolution has never been more central to the task of theology, and theology has never been more important as a means of interpreting this stage in the unfolding of a cosmic purpose.

He believes that evolution provides sufficient common ground for religion, philosophy, and science to be able to subscribe:

> "[T]he concept of evolution, invented by philosophy and now fully embraced by science, is acceptable to all but the most fundamentalist religions. Its broad approval is why an appreciation and understanding of evolution in its most awesome sense--cosmic evolution, a scientific philosophy capable of applying the tools of technology to the time-honored questions first posed by philosophers and theologians--can provide a map for the future of humanity."[13]

It has become our task to make the next phase of evolution an "ethical evolution,"[14] in which we play an active and creative role. In so doing we implicitly transcend the Darwinian principles of natural selection. Thus:

> To employ cosmic evolution as an intellectual as well as a practical guide toward the Life Era is to think in dynamic rather than static terms, to forge a link between natural science and human history, to realize the evolutionary roots of human values, to renew a sense of hope.... I suggest that cosmic evolution is a powerful synthesis to use as perspective.... From the study of cosmic evolution may well emerge a sense of 'big thinking' and with it the global ethics and planetary citizenship needed if our species is to have a future. In the words of Søren Kierkegaard, 'Life can only be understood backwards, but it must be lived forwards.' Tritely stated though no less true, our future will likely be a measure of our current wisdom.[15]

There is no question that this credo of Chaisson's has a religious quality.[16] And perhaps it marks the possibility of a true revival of interest in the religious spirit itself.[17] Alfred. North Whitehead's remark comes to mind: "Religion will not regain its old power until it can face change in the same spirit as does science. Its principles may be eternal, but the expression of those principles require continual development.... The progress of science must result in the unceasing codification of religious thought, to the great advantage of religion."[18]

As Gordon Kaufman correctly reminds us, theology is "a human imaginative task."[19] I would argue that the issue of "planetary ethics" is indeed a fundamental question that must be addressed by theologians within all the major religious traditions. Perhaps the theologian who has most directly tackled this issue to date is Hans Küng in his *Global Responsibility: In*

Search of a New World Ethic. For Küng, a "world ethic" would reflect our common evolutionary heritage, and even more particularly, our willingness to embrace a common future destiny. As such, "theologians should attempt to construct conceptions of God, humanity, and the world appropriate for the orientation of contemporary human life." [20]

Washington Gladden's "Organic Law of Human Society"

> The social gospel movement took shape during the years when evolution was making its converts among the progressive clergy, and since ministers who were liberal in social outlook were almost invariably liberal in theology also, the social theory of the movement was readily affected by the impact of naturalism upon social thought. The growing secularization of thought hastened the trend among clergymen to turn from the abstractions of pure theology to concrete social questions. The liberalization of theology broke down the insularity of religion. Social gospel leaders were also inspired by the vistas of development opened both forward and backward in time by the evolutionary perspective; and their belief in an inevitable progress towards a better order on earth - the Kingdom of God - was fortified by the evolutionary dogma.... This combination with scientific evolutionary thought has freed the kingdom ideal of its catastrophic setting and its background of demonism, and so adapted it to the climate of the modern world. Spencer's organic interpretation of society also appealed to the progressive clergy, although they usually put it to uses of which he would have sternly disapproved. For them the social organism concept meant that the salvation of the isolated individual had lost its meaning, and that men in the future would speak with Washington Gladden of 'social salvation.'
>
> --Richard Hofstadter [21]

It may seem a little incongruous to consider at this point the work of a theologian who commenced his pastoral ministry over a century ago. And yet, the work of Washington Gladden (1836-1918), while somewhat in eclipse for most of this century, is instructive for a contemporary theology of social solidarity. Gladden, regarded as the "father" of the social gospel,[22] attempted to fit a distinctly liberal theological focus on the progressive emergence of the kingdom of God (the primary theological motif of the social gospel movement) into an evolutionary theoretical framework. However, Gladden's interpretation of Social Darwinist ideas was especially critical of Spencer's laissez-faire economics and non-interventionist social policies (championed in America by the Yale sociologist William Graham Sumner), while also steering a path away from the more radical versions of socialism.

According to Jacob Dorn, whose work constitutes the major single study of Gladden's life and teaching, "Evolution became the leaven of his religious and social thought, and the authority of its philosophical implications was, for him, unchallenged." [23] Gladden was particularly influenced by the philosophy of John Fiske, who maintained "that evolution was another evidence of divine purpose and the optimistic law of progress." [24] Like Gladden, Walter Rauschenbusch saw that the progressive nature of the kingdom of God was supported by the scientific theory of evolution: "Translate the evolutionary theories into religious faith, and you have the doctrine of the Kingdom of God." [25]

As early as 1870, Gladden was preaching about Darwinism and the link between natural and social evolution. He argued that while evolutionary theory had shown a natural progress in life forms best adapted to their environment, this did not guarantee that the best or ideal forms ultimately survived. In a mean society, the mean are probably the most fitted for survival. It was therefore the role of religion to foster the social virtues of love and compassion, and to promote the common good. In this way the recognition that we are part of a social organism dawns upon humankind, and we realize our divinely appointed role in fostering the divine consciousness that leads inevitably to the fullness of God's kingdom.

Throughout his many books and published sermons, Gladden stressed three related ideas in social Christianity consistent with an evolutionary approach: (1) the immanence of God in the cosmic process, (2) the organic or solidaristic view of society, and (3) the presence and growth of the kingdom of God. For Gladden, the

evolutionary view of the universe helped to ground the doctrine of divine immanence:

> The God in whom we live and move and have our being will not need to be certified by documents or symbolized by sacraments or demonstrated by logic; our knowledge of him will be immediate and certain. If He is, indeed, the Life of all life; if He is 'more present to all things He made than anything unto itself can be'; if He is 'stream of tendency, whereby all things fulfil the law of their being'; if He is really 'working in us, to will and to do of His good pleasure,' then life possesses a sacredness and a significance which few of us have yet conceived. This truth sanctifies and glorifies the whole of life. It is the truth which lies at the heart of what is known as the 'new theology'; and, if the Christian pulpit can but grasp it and realize it, we shall have such a revival of religion as the world has never seen.[26]

For Gladden, the theological appropriation of evolutionary ideas supported the two principal truths of the social gospel: the "Fatherhood of God" and human "Brotherhood." The doctrine of the "Fatherhood of God"--as exemplified in the life and works of Jesus--shifted the focus away from the view of God as a distant monarch, to that whereby God and the creation are enmeshed in a relationship of filial love:

> The doctrine must have vast social consequences. When it is once fully accepted, and all that it implies is recognized and enforced, society will be regenerated and redeemed. If all men are, indeed, brothers, and owe to one another, in every relation, brotherly kindness; if there is but one law of human association - 'Thou shalt love thy neighbor as thyself'; if every man's business in the world is to give as much as he can, rather than to get as much as he can, then the drift of human society must now be in wrong directions, and there is need of a reformation which shall start from the centers of life and thought.[27]

As a liberal, Gladden believed that with sufficient moral education mediated by the key social institutions,[28] people could be made aware of their organic relationship to each other and to God. However, he was also disturbed by the fragmentation of knowledge, whereupon scientific knowledge could be isolated from humanitarian, cultural, and religious knowledge. If, as he believed that evolution showed, the whole universe was revelational, then all knowledge, whether of the rational, mystical, moral or cultural dimensions, were to be integrated as truth.[29] Gladden addressed the issue of reconciling religious and scientific knowledge in his book, *Burning Questions.* In the first essay, entitled, "Has Evolution Abolished God?" he not only answers in the negative, but goes on to argue that evolutionary theory can be put to use as an apologetic for the existence and activity of God in the cosmos. Indeed, the "dynamic and creative cosmos of Darwin was a much more exciting, mysterious, and free universe than the static, self-contained, mechanical one of Copernicus and Newton."[30]

For Gladden, developments in nineteenth century science had shown that God was immanent and omnipresent. Fry and Fry express this idea of the dynamic evolutionary model quite nicely: "History moved into eschatology--liberty now joined spirituality, rationality, community and morality in the process. Freedom with faith and reason, coupled with fellowship, led to a forward momentum for the human family."[31]

One of the reasons why the social gospel lost its momentum after World War I was precisely the fact that it was seen to be overly optimistic about the human condition. As Hopkins shows in his classic study of the movement, "[t]he religious rationalization of evolution carried with it the uncritical assumption of the corollary belief in progress. Many Protestant thinkers saw the process of development at work in the religious and moral realms as well as nature. Progress was held to be real and evolution to provide cosmic sanction for trust in the ultimate triumph of good."[32] There is no doubt that the major theological work of our century to express such optimism in progressive evolution is that of Pierre Teilhard de Chardin. But in effect, this is probably nothing more than the last sigh of a theology of predestination. We cannot escape the fact that we live in a contingent universe. Nothing is determined--cosmic evolution is an open process. As reflexively conscious beings, we have reached the stage in cosmic evolution where we are able to act as creative agents in the whole process. We may not be able to have Gladden's confi-

dence in the divine unfolding of the kingdom of God through evolution, but we can at least recognize the invaluable role that an ecologically sound theology of social solidarity can play in shaping the future.

Templeton Prize-winning Australian scientist and process theologian, Charles Birch, makes the point that since both science and religion are moving away from substantialist presuppositions--recognizing that they use different models for explaining the world--it may be that they will "find new depth in each other's endeavours"[33] Moreover, one "objective of theology is to bring science and religion closer together in a 'deeper religion and a more subtle science.'"[34] It is certainly true that theology can no longer claim to read directly the divine revelation in the book of nature; the truth about nature is best approached through the application of scientific methodology. Theologies are constructed to serve a hermeneutical purpose. They exist as cathedrals of the mind; places where spiritual, aesthetical, and moral concerns can be crafted and sent forth into the world. Washington Gladden's evolutionary theology of social solidarity is one such example. It has the distinct virtue of providing a meaningful social vision for humanity that directly challenges the destructive acids of atomistic egoism, cynicism, and despair:

> "Human beings are made to live together upon this planet and to find in mutual cooperation a large part of the good of being. The law of life is therefore love or good will. They are sharers in one another's welfare; each one is largely dependent for his happiness on the well being and well doing of his fellows. This is the organic law of human society...."[35]

The human factor: Hefner on evolution, culture, and religion

Philip Hefner's *The Human Factor* is a major work of constructive theology. It encompasses a breadth and depth of learning that is impossible to convey in such a short summary. Starting with biocultural evolution and leading to a balanced ecological view of humans as co-creators, it offers perhaps the closest theological counterpart to the work of Eric Chaisson.

Following the same perspective as Chaisson, Hefner writes:

> The picture of cosmic evolution contains, therefore, at least four segments: Big Bang cosmology, biological evolution, human ontogeny, and cultural development. Although each of these is distinct from the others in its particular laws of unfolding, more and more observers are recognizing that the several phases can be considered as portions or dimensions of one cosmic evolution.[36]

He wants to construct a framework of meaning that locates the human person within the whole scope of cosmic evolution. This task of explication he holds to be primarily that of the theologian, although philosophers, scientists, artists, and poets each have a role to play in the formation of a meaningful symbolic cultural world. However, he is quick to point out the past failures of theology to work constructively with the sciences in articulating a cogent worldview:

> Theology has far to go if it is to engage the possibilities offered by the sciences for articulating the Christian insights in a way that is intelligible, let alone cogent, within the configurations of mind that have been nurtured in the bosom of the modern sciences.[37]

His theology (which he proposes as a fully fledged and testable theory after the analysis of Imre Lakatos) is an attempt to address this problem and thus contribute to the reconciliation between science and religion.

The work commences with the question, "Who are human beings?" And the core proposal for his answer is: "Human beings are God's created co-creators whose purpose is to be the agency, acting in freedom, to birth the future that is most wholesome for the nature that has birthed us--the nature that is not only our own genetic heritage, but also the entire human community and the evolutionary and ecological reality in which and to which we belong. Exercising this agency is said to be God's will for humans."[38] Moreover, the evolutionary process is the conditioning matrix that produced the human being as a more complex phase in the emergence of a free creation.[39] This free creation--an open-ended process--has come about because

humans have evolved as reflexively conscious creatures and have developed cultures and technologies that now directly influence the on-going process of creation. Human consciousness is nothing short of the cosmos becoming conscious of itself.

Hefner reduces his theological theory to three basic points:

> 1. The human being is created by God to be a co-creator in the creation that God has brought into being and for which God has purposes.
> 2. The conditioning matrix that has produced the human being--the evolutionary process--is God's process of bringing into being a creature who represents the creation's zone of a new stage of freedom and who therefore is crucial for the emergence of a free creation.
> 3. The freedom that marks the created co-creator and its culture is an instrumentality of God for enabling the creation (consisting of the evolutionary past of genetic and cultural inheritance as well as the contemporary ecosystem) to participate in the intentional fulfillment of God's purposes.[40]

We may not be able to have Gladden's confidence in the divine unfolding of the kingdom of God through evolution, but we can recognize the invaluable role that an ecologically sound theology of social solidarity can play in shaping the future.

Hefner goes to considerable lengths to ground his theological theory and the created co-creator in the natural evolutionary order. As he puts it:

> This creature not only creates its meanings, grounded in its experience of the natural world...but it has adapted so successfully to its global ecosystem that it has been able to impose an overlay upon the pre- and nonhuman systems of nature, such as those systems are thoroughly conditioned by human cultural inputs. All this is rooted in the evolved human creature, who is within itself a symbiosis of genes and culture, and who through its culture continually seeks to bring its genes and the rest of its environment into conditions of existence that only the culture-forming co-creator would ever dream of. The point is that nature should function, in large part, as *Homo sapiens* desires it to function, so as to become in fact the world that the created co-creator believes is most desirable for its existence.[41]

This awesome responsibility has now become ours, and in order to resist the temptation to anthropocentrism, the created co-creator needs to work at developing an appropriate ethics that takes into account the entire planetary ecosystem.

Justice for the whole creation: Daly and Cobb

In their influential book--synthesizing political, economic, and theological concerns--Herman Daly and John Cobb have called for a "biospheric vision."[42] By this they mean, first of all, a paradigm shift away from the contemporary economic understanding of human beings as *Homo economicus*[43] *Homo economicus* is the assumption that discrete individuals exercise rational choice so as to maximize their self-interest. In terms of social policy, this economic view has led to the breakdown of the welfare state (a particular politico-economic organization of the *common weal*) and the resurgence of Social Darwinism, taking us back again to the domain of conflict in which Gladden's ideas emerged. As Daly and Cobb put it, "Economists typically identify intelligent pursuit of private gain with rationality, thus implying that other modes of behavior are not rational. These modes include other-regarding behavior and actions directed to the public good."[44]

This narrow view of the human person is not merely mistaken--failing to take into account all the socializing influences that persist in an individual's life--but it is extremely dangerous from the perspective of enhancing the ecology of the social and environmental worlds. Rather than building on the ecological vision implicit within evolution, the *Homo economicus* is a throwback to the dualistic pre-evolutionary doctrine of dominion, in which human beings are created as distinct entities to lord it over the rest of creation. For Daly and

Cobb (as process theologians), stewardship of the earth starts by recognizing *Homo economicus* as "person-in-community."[45]

A "biospheric vision" recognizes that anthropocentric dualism is an inadequate framework within which to build a global ethics. "The point here is," Daly and Cobb remind us, "that when economists deal with living things, and especially with large systems of living things, they cannot think of these *only* as resources for fueling the human economy. Instead, the human economy needs to be shaped with the health of the biosphere in view."[46] The biosphere is a society of interrelatedness, a society of societies: "To view human relations with other living things in the context of a community of communities is to move into a biospheric vision."[47] Evolution clearly provides epistemic grounds for an ethics that moves us from the flawed notions of atomism and anthropocentric dualism to "a homeostatic one serving the common goal of individual and communal survival and growth."[48]

Daly and Cobb stress the need to move from *chrematistics* to *oikonomia*. In doing so, they borrow a distinction made by Aristotle. Chrematistics "can be defined as the branch of political economy relating to the manipulation of property and wealth so as to maximize short-term monetary exchange value to the owner. Oikonomia, by contrast, is the management of the household so as to increase its use value to all members of the household over the long run. If we expand the scope of the household to include the larger community of the land, of shared values, resources, biomes, institutions, language, and history, then we have a good definition of "economics for community."[49] Oikonomia does not lend itself to the kind of reductionistic forms of rationalism evident in what we have come to know as economic rationalism. Economic rationalism (which is closely allied to social Darwinist policies) is perhaps the most obvious example of chrematistic thinking in political economy. Oikonomia is as much concerned with social capital as it is with monetary capital. Indeed, it sees the economy as simply one means by which benefits might be generated for the community as a whole, rather than reducing all social interactions to questions of instrumental economic rationalities.

Daly and Cobb--as Christian theists--acknowledge that the biospheric vision is not only consistent with evolution (to coin a metaphor: we are all cut from the same cloth), but also with a rich religious understanding of the cosmos. For instance, many traditional religious worldviews have expressed the deep sacred ties that exist between all living entities; and in the case of the Australian Aboriginal "dreamtime," these sacred links extend to the land, sea, and air. Daly and Cobb agree, however, that modern Western Christianity has often been opposed to biospheric thinking, given that it has readily been expressed in terms of anthropocentric dualism.[50] Nevertheless, the biospheric vision "is richly inclusive and transformative of human perceptions. Once community with other living things is truly experienced and appreciated, aspects of our thinking and our way of life previously taken for granted become unacceptable. In short it is in itself a religious vision. The rise of this vision, especially through the influence of ecological and feminist sensitivities, has been one of the great advances of this generation. Only as the vision deepens and spreads is there hope for making the changes that are required...."[51]

The biospheric vision of "deep ecology" is intimately related to evolution for its epistemological grounding, and to religious sensibilities for its ethics of social solidarity.

The biospheric vision of "deep ecology" is therefore intimately related to evolution for its epistemological grounding, and to religious sensibilities for its ethics of social

solidarity. The task of a theology of social solidarity is to bring these two facets--the epistemological and the ethical--together.

Conclusion: Towards a "Planetary Theology" in the reconciliation between science and religion

> Darwinian evolution, in indicating that all species of earthly life are related and that all arose from ordinary matter, made it clear that there is no wall dividing us from our fellow creatures on earth, or from the planet that gave us all life - that we are such stuff as worlds are made of. --Timothy Ferris[52]

The links between social solidarity and evolution extend beyond the fact that life is "all of a piece." In a real sense, our very survival depends upon our mutual cooperation.[53] We are therefore inextricably bound together in a common destiny.

Jürgen Moltmann reminds us from a theological perspective of what Eric Chaisson has to say from a scientific one--that evolution implies an open-ended view of the creation:

> Today, the direct continuation of the evolution that led to the origin of the human species on earth lies in the hands of human beings themselves. They can either destroy this stage of evolution, or they can organize themselves into a higher form of common living than before, and advance evolution further.[54]

Indeed, one might even find within this open-ended, contingent view of cosmic evolution the intimations of a democratic social order. Moltmann argues that as an open system, the universe is both a *participatory* system and an *anticipatory* one: "It would seem that the universe contains within itself the trend towards the universal symbiosis of all systems of life and matter."[55] As an anticipatory system, the universe is capable of self-transcendence, which has become possible through its having evolved reflexively conscious creatures, capable of being co-workers in the process of evolution.

To conclude then, many of the themes already covered in this essay have been summed up in the profound liberation theology of Sri Lankan theologian Tissa Balasuriya. A Roman Catholic, he speaks of a "planetary theology" and the need for a holistic perspective to tackle social, economic, and environmental problems from a world-systems perspective. Indeed, "[t]he present world system of human relationships did not arise in a day or a generation. It is the result of a protracted historical evolution of the human race in its relationship to nature, of different peoples and cultures to one another, of the sexes to each other."[56] He concludes:

> The spirituality of the Christian must therefore include a love of the whole of humanity in its return to the Creator; it also requires a love and service of the universe, and of our planet earth. Christian spirituality has to be open to the good in all others whatever their religion or ideology, for Christ is all in all. Christians have to be both radical and conservative - radical in order to participate in the revolutionary changes that reshape our societies for the better and conservative in order to preserve what is valuable in all ages and cultures. They are called on to conserve the radicality of the revelation in Jesus Christ. This is an important challenge to all believers in Christ, especially those in the Western countries and the local elites of poor nations. A rethinking of Christian theology is essential today for both the personal fulfillment of each unique human person and the global survival and evolution of the human race and of the universe.[57]

As we have seen throughout this essay, both theology and science have important roles to play in the formation of a new "planetary ethics." May it be that the reconciliation between these two noble disciplines will lead humankind to a fuller realization of its co-creative task in the evolution of the cosmos.

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Endnotes:

[1]Gladden, "The Outlook for Christianity," pp. 269-70.

[2]Among the many one might think of: T. F. Torrance, Karl Schmitz-Moormann, Arthur Peacocke, John Polkinghorne, and Charles Birch.

[3]An admirable account of the rise of this fundamentalist movement is given by Numbers.

[4]Peacocke, *Theology for a Scientific Age*, p. 5.

[5]Chaisson, "Our Cosmic Heritage," p. 470.

[6]*Ibid.*, p. 471.

[7]Peacocke, *Creation and the World of Science*, p. 305.

[8]Kaufman, p. 105.

[9]In the earlier part of this century the Harvard geologist, Kirtley Mather, touched rather presciently on this point: "To discover the moral quality of the universe, man must be vividly aware not only of those things which have time-space relations, but also of those values which transcend such relations. That discovery is possible only through the cooperative endeavor of those who strive to utilize all potential capabilities of mankind. Toward this goal, science and religion are advancing hand in hand." Mather, p. 156.

[10]Chaisson, *Cosmic Evolution*, p. 38.

[11]Chaisson believes that the Life Era heralds a whole new direction for cosmic evolution since human technology actually begins to influence the future. "Because technology, for all its pitfalls, enables life to begin to control matter, much as matter evolved to control radiative energy more than ten billion years ago. As such, matter is now losing its total dominance, at least at those isolated residences of technical competence. This change, from matter-dominance to life-dominance, I claim is the second of two preeminent events in the history of the Universe." Chaison, "Our Cosmic Heritage," p. 473.

[12]*Ibid.*, pp. 473-74.

[13]*Ibid.*, p. 476.

[14]*Ibid.*, p. 477.

[15]*Ibid.*, pp. 478-79.

[16]In his book, *A Common Faith*, John Dewey foreshadows the emergence of humanistic religious ideals: "It is widely supposed that a person who does not accept any religion is thereby shown to be a nonreligious person. Yet it is conceivable that the present depression in religion is closely connected with the fact that religions now prevent, because of their weight of historic encumbrances, the religious quality of experience from coming into consciousness and finding the expression that is appropriate to present conditions, intellectual and moral.... I believe that many persons are so repelled from what exists as a religion by its intellectual and moral implications, that they are not even aware of attitudes in themselves that if they came to fruition would be genuinely religious" (p. 9). What is needed is to "emancipate the religious quality from encumbrances that now smother or limit it..." (p 10). Moreover, "[w]e who now live are parts of a humanity that extends into the remote past, a humanity that has interacted with nature. The things in civilization we most prize are not of ourselves. They exist by grace of the doings and sufferings of the continuous human community in which we are a link. Ours is the responsibility of conserving, transmitting, rectifying and expanding the heritage of values we have received that those who come after us may receive it more solid and secure, more widely accessible and more generously shared than we have received it. Here are all the elements for a religious faith that shall not be confined to sect, class, or race. Such a faith has always been implicitly the common faith of mankind. It remains to make it explicit and militant" (p. 87). This is not unlike what Chaisson is trying to do.

[17]Arthur Peacocke addresses himself to issues similar to Chaisson's, albeit from a theological perspective, in a chapter entitled, "Natural Human Being: The Perspectives of the Sciences and Their Implications for Theology," *Theology for a Scientific Age*, pp. 213-54.

[18]Whitehead, p. 219.

[19]Kaufman, p. 32.

[20]*Ibid.*, p. 31.

[21]Hofstadter, pp. 88-89.

[22]Dorien, p. 19

[23]Dorn, p. 168.

[24]Wish, p. 327.

[25]Rauschenbusch, p. 90.

[26]Gladden, "The Outlook for Christianity," pp. 274-75.

[27]*Ibid*, pp. 275-76.

[28]See, in particular, his *Social Facts and Forces*. This book represents his major contribution to the emerging discipline of sociology in the United States. Many of his ideas about social solidarity in industrial society are quite like those outlined by Emile Durkheim's "organic solidarity."

[29]Charles Birch deals with this same problem from a contemporary perspective, and his answer is not unlike that of Gladden's: "The fragmentation of knowledge has its far-reaching implications. It has produced destructive conflict between individuals, disciplines, ideologies and nations. It has helped to plunge the world into the global crisis of management in which we seem unable to utilize the world's resources without massive environmental deterioration. As we attempt to save ourselves we are in danger of losing the world. The problems of global management are all connected. You can no longer do only one thing. Resource shortages, unemployment, inflation, environmental deterioration, population explosion and crime are all interconnected. This network of problems won't be solved by any one expert or any number of experts. It is one problem and has to be tackled as one. Experts can't do that because they have tunnel vision. What is needed is a panoramic view." Birch, p. 140.

[30]Fry and Fry, p. 14.

[31]*Ibid.*, p. 16.

[32]Hopkins, p. 130.

[33]Birch, p. 147.

[34]*Ibid.*

[35]Gladden, *The Forks of the Road*, p. 35.

[36]Hefner, p. 108.

[37]*Ibid.*, p. 37.

[38]*Ibid.*, p. 27.

[39]*Ibid.*, p. 42.

[40]*Ibid.*, p. 32.

[41]*Ibid.*, pp. 277-78.

[42]See Daly and Cobb.

[43]*Ibid.*, p. 5.

[44]*Ibid.*

[45]*Ibid.*, p. 7.

[46]*Ibid.*, p. 202.

[47]*Ibid.*, p. 203.

[48]Loewy, p. 46.

[49]Daly and Cobb, p. 138.

[50]Ibid., p. 376.

[51]*Ibid.*, p. 377.

[52]Ferris, pp. 367-68.

[53]This perspective is quite different from the one proposed by social Darwinists--where only the fit may survive. It is not surprising to see this view held most strongly by people inclined towards economic rationalism. Their worldview grew out of the Enlightenment's fascination with a mechanical universe, and as a consequence they find it extremely difficult to see the world from a holistic (ecological) perspective. Because they see evolution from the perspective of the many parts, they are led to believe that it involves merely a competition in which the fittest survive the process of natural selection. This, however, is not the tive of the whole is a history of gains through the accumulation of more and more complex interrelations between cooperating systems. See Dawkins.

[54]Moltmann, p. 196.

[55]*Ibid.*, p. 205.

[56]Balasuriya, p. 17.

[57]*Ibid.*, pp. 191-92.

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This essay was awarded a First Prize.

Psychoanalysis and God: A Comparative Analysis of Jacques Lacan and John of the Cross

Ted Kepes, Jr.

The author makes the case that Lacan and John of the Cross, taken together, reveal the full spectrum of the human journey toward God. Lacan's psychoanalytic theory is a valuable resource for understanding the earlier stages of the comprehensive spiritual development of the human person. By contrasting Lacan's thought with the spiritual theology of John of the Cross, the author finds that both of them coordinate their understanding of human psychology in terms of the tripartite division of the imaginary, the symbolic, and the real.

Jacques Lacan

Jacques Lacan's project is rooted in a return to the work of Sigmund Freud, especially in what Lacan considers to be Freud's essential message: that the unconscious is structured like a language.[1] The development of the ego, for Lacan, begins in what he calls the "Mirror Stage" which occurs sometime between the sixth and eighteenth month of the newborn in the *infans* stage (without speech). Prior to birth, the fetus's body is united with the body of the mother, which supplies it with an environment of connectedness and wholeness (nutrients, security, warmth). The birth of the fetus results in a radical separation from the mother, which ruptures its sense of completeness. At some point, the infant attempts to recover its lost experience of wholeness by recognizing itself as the perceived reflection in some other, such as the mothering one. The infant's identification with the images of sensory perception leads to a sense of control, unity, and wholeness, which eases the discomfort of the fragmentation and provides a sense of unity and completeness. The infant, and the sensory world of its environment, become one. Lacan calls the object of the infant's unification the "mOther," for although the object of union involves the whole of sensory experience that is Other, it is most centered on the primary caregiver, or mother. The relationship between the infant and the mOther is characterized by an immediate and imaginary union. The fact that the origin of the development of the ego is constituted by an imaginary reflection in the external mOther will remain an essential element in the whole of Lacan's work. Thus, the subject remains incomplete, a fragment in itself and will strive in vain to reach wholeness in a unification with the Other.

Human being inevitably moves beyond infancy as the child begins to babble. With its movement into the symbolic order of language, or the law of the father, as it is called by Lacan, its imaginary oneness with the mOther is ruptured. This "moment in which desire becomes human is also that in which the child is born into language."[2] Entrance into the symbolic order "raises desire to a second power," as it forces one to signify the Other, which is now mediated by language. The once-immediate union with the mOther is no longer possible. Having previously identified itself with the totality of the mOther, the child, whose movement into the symbolic order causes it to experience a separation from this fullness, henceforth attempts to retrieve the lost Object through the mediation of the symbolic order. These symbolic representations, however, can only signify a lack: "For the signifier is a unity in its very uniqueness, being by nature symbol only of an absence."[3] The signifier is a symbol of an absence because

the mOther, with whom the infant previously identified, was never truly possessed. At best, the union was characterized by only images and mirror-like reflections.

As long as the signifier is constitutive of the subject, one is at the mercy of the law of the symbolic order.[4] Rather than allowing one to reach the object of one's desire, it forces an even greater separation. As one becomes more separated, one seeks, more desperately, that which one lacks; but in so doing, one is again forced to do so within the alienating function of the symbolic order.

> So runs the signifier's answer, above and beyond all significations: "You think you act when I stir you at the mercy of the bonds through which I knot your desires. Thus do they grow in force and multiply in objects, bringing you back to the fragmentation of your shattered childhood. So be it: such will be your feast until the return of the stone guest I shall be for you since you call me forth."[5]

This play between one's action and desire, "and of the former's fundamental failure to catch up with the latter," suggests the comic dimension of the human condition[6]. This comic dimension shows that the relationship is not one of triumph of action over desire, but reveals the continuation of the futile situation we can find ourselves in.

The third component in the Lacanian triad is the "real". For Lacan, there is an important distinction between the term "reality" (which refers to what we can have access to in the imaginary and the symbolic) and the "real," which is precisely that which is apart from being imagined or symbolized. The real is the "impossible" because it is beyond that which is grasped within the imaginary or the symbolic. Because of the distinction between reality and the real, there is a radical separation of Lacan's epistemology from ontology. When truth "speaks" in *The Freudian Thing*, it does not reveal "real" being, but unveils itself as the lie, the mistake, and the error. Truth says:

> Let a sharper scent than all your categories guide you in the chase to which I incite you: or if the cunning of reason, however disdainful she may be of you, remained open to your faith, beside you, I, the truth, would be Deceit itself, since my ways pass not only through a crack too narrow to find for want of pretense and through the inaccessible cloud of the dream, through the motiveless fascination of the mediocre and the seductive impasse of absurdity.[7]

Lacan concludes that the truth is a lie and reality is absurd because it is not possible to get to the real.

Remarkably, this conclusion was actually the essential message of John of the Cross: as long as humanity is separated from that which is ultimately real, the truth we do have is a lie and the reality we do perceive *is* absurd. Both Lacan and John of the Cross agree that life becomes tragic when there is a separation between desire and the object of fulfillment. They also agree that dependence on the images of sense experience and the symbolic order of concepts, thoughts, imagination, and memory, serve to alienate one from that which is most real. But while for Lacan there is no escape from the imaginary and symbolic, John of the Cross maintains that the human condition remains tragic *only* as long as one identifies reality exclusively as the imaginary and the symbolic. The crucial difference lies in his conviction that it is possible, though difficult, to be led by grace to go out of one's "house" of images and symbols where one can be united with the supreme reality of God.[8]

It is simply the case that what one can become aware of in faith goes beyond the conceptual apparatus of human reason. This transition is like a journey into the dark night only because of the human tendency to have an inordinate dependency on the intellect as the full expression of reality.

John of the Cross

John of the Cross' transformative encounter with this vast and mysterious, though supremely real, presence of God led him to realize we are all part of a tremendously vast horizon that goes far beyond our ability to sense, understand, imagine, or know. In terms of the human person, John of the Cross uses the term "soul" to convey this fullness of our being. The soul is understood in terms of various levels: the sensory part being located at the most external level, allowing for sense experience, natural appetites and drives; the spiritual part exhibits the deeper levels of human nature, allowing for the faculties of the intellect, memory, and will; and at the deepest center of the soul of the human being is the very presence of God.[9] Although our sense experience and limited capacity to understand tell us something of this vast horizon of the supremely real, we can easily be fooled into thinking that they are the full expressions of the real. These limited abilities, which allow a glimpse of a part of the real, can become hindrances if not understood in the context of the more comprehensive and mysterious whole.

It seems Lacan, and many of the postmoderns, have become excessively attached to the imaginary and symbolic as the only expressions of reality. While it is certainly the case that the human person moving toward the infinite horizon of God needs to pass through the imaginary and symbolic stages, the only way one can begin to become aware of the fullness of this larger horizon is to let go of one's exclusive dependence on these more limited capacities. This movement is described as a journey into the "dark night" of the senses and spirit. The movement beyond what Lacan describes as the imaginary is addressed by John of the Cross in the dark night of the senses; the movement beyond Lacan's symbolic is addressed in his dark night of the spirit.[10]

The journey toward union with God is necessarily dark, because all that we have become accustomed to bringing light (sensation and understanding) are no longer prioritized. This movement necessarily involves a shifting of perspectives, from the limited and narrow view of the senses and understanding, to the ultimate, all-encompassing horizon of God in faith. Faith is the theological virtue that corresponds to the human intellect. Although it is certainly the case that one needs to move beyond complete dependence on the human intellect to grasp the fuller context of the real that is God, it is not the case that faith is void of any content at all. It is simply the case that what one can become aware of in faith goes beyond the conceptual apparatus of human reason. Again, this transition is like a journey into the dark night only because of the human tendency to have an inordinate dependency on the intellect as the full expression of reality. Although faith may seem to be obscure and ambiguous, this is not because it is irrational or chaotic, but because the limitedness of the human condition prevents an understanding of its infinite intelligibility.

What is required is simple; its actualization, however, is tremendously difficult. John of the Cross is not suggesting we stop thinking, imagining, reflecting, or understanding; rather, that we not depend exclusively on these abilities as the final means toward the real. Only in letting go of our attachment to these limited human abilities can we hope to become aware of the fuller context of God. "For the less a soul works with its own abilities, the more securely it proceeds because its progress in faith is greater."[11] Human reliance on the intellect alone functions to blind one to the light of God, which is revealed only when the excessive dependence on this faculty is eliminated. "Such is faith to the soul; it informs us of matters we have never seen or known, either in themselves or in their likeness. In fact, nothing like them exists. The light of natural knowledge does not show us the object of faith, since this object is unproportioned to any of the senses."[12] Thus, in the dark night of the spirit, one must rely on the content of faith as one's

guide simply because it alone is able to rest on the fullness of the real. Any other dependence will necessarily be less than this fullness, and may cause one to be deceived about the truth.

Concluding thoughts

If one is inordinately attached to an intellectual system, one's whole intentional world becomes that intellectual system. Living life *only* from within the bounds of the imaginary and symbolic would force one to experience and understand the world *only* in terms of that limited perspective. Confining oneself to this limited worldview would render one unable to consider any other alternative, precisely because of the limited scope of that particular worldview. It would seem that Lacan's psychoanalytic theory suffers from just such a self-imposed limitation. His *conviction* that humanity is trapped in the imaginary and symbolic order is the very thing that keeps him from becoming open to other possibilities. Rather than searching for any possible solution, he looks to the psychoanalytic tradition to help him and others cope with their affliction. It is precisely this kind of resolute attachment to the imaginary and symbolic that keeps one from being led beyond them toward God who alone can satisfy the whole of our desire.

> Only those who set aside their own knowledge and walk in God's service like unlearned children receive wisdom from God. This is the wisdom about which St. Paul taught the Corinthians: *Si quis videtur inter vos sapiens esse in hoc saeculo, stultus fiat ut sit sapiens. Sapientia enim hujus mundi stultitia est apud Deum.* [If any among you think they are wise, let them become ignorant so as to be wise. For the wisdom of this world is foolishness with God.] Accordingly, to reach union with the wisdom of God a person must advance by unknowing rather than by knowing.[13, 14]

Lacan's clinical experience and psychoanalytic theory suggest precisely what can happen if one relies exclusively on the limited human capacities to experience and understand reality. His tragic conclusions are only symptoms of his failure to be led beyond the prison of his own subjectivity. Whereas Lacan's psychoanalytic system embodies the "turn to the subject" that has been the hallmark of the Modern and Post-modern worldview, the spiritual theology of John of the Cross embodies the "turn to the object" of revelation that has characterized so much of the Ancient and Medieval worldview. Both viewpoints emphasize important and legitimate aspects of the whole of reality. If it is the case that the entire "one-verse" of creation is an expression of God, then this expression will be understood adequately only insofar as the whole is considered. The time has come for humanity to move beyond the limited fixation on either the objective or the subjective poles of reality and to embrace an integration of the whole.

Lacan's system brilliantly develops the psychological, epistemological, anthropological, and linguistic character of the imaginary and the symbolic. If applied to the night of the sense and spirit in John of the Cross, it would allow for a development that could go well beyond the capability and understanding of the sixteenth century. But whereas this development could explain more fully the difficulties and consequences of life strictly within the imaginary and the symbolic, John of the Cross is able to show how one can become aware of the ultimately real that goes beyond the limitations of the strictly human faculties. Taken together, Lacan and John of the Cross reveal more adequately the fullness of human being. Understood in its proper context, Lacan's elaborate description of the imaginary and symbolic stages can be regarded as *expressions* of God rather than limited and

If it is the case that the entire "one-verse" of creation is an expression of God, then this expression will be understood adequately only insofar as the whole is considered.

absolute ends in themselves. However, the only way to *real-ize* the theological significance of Lacan's work is to move beyond it. Only by being led beyond the imaginary and symbolic stages can one hope to understand them as aspects of the fuller context of the comprehensive horizon of God in faith.

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Endnotes:

[1]Lacan, *Ecrits: A Selection*, p. 159.

[2]*Ibid.*, p. 103.

[3]Muller and Richardson, p. 39.

[4]Drawing on the work of Ferdinand de Saussure, Lacan stresses that despite the inability of the imaginary and symbolic to represent the lost Object, one can, nonetheless, understand something of the structure of the symbolic order. See de Saussure.

[5]Muller and Richardson, p. 52.

[6]Lacan, *The Seminar of Jacques Lacan: Book VII,* p. 313.

[7]Lacan, *Ecrits: A Selection*, pp. 121-123.

[8]In the poem, "The Dark Night," one goes out of one's "house" into the dark night to be united with the Beloved. See John of the Cross, "The Dark Night," pp. 50-52.

[9]John of the Cross, "The Living Flame of Love," 1: 9-17, pp. 644-647.

[10]It is important to note that both the night of senses and the spirit involve an active stage, in which one actively prepares oneself for divine union, relying on faith alone; and a passive stage, in which one passively assents to being moved to complete union with God in complete darkness.

[11]John of the Cross, "The Living Flame of Love," 2:1:3, p. 155.

[12]*Ibid.*, 2:3:3, p. 158.

[13]1 Corinthians 3:18-19.

[14]John of the Cross, "The Ascent of Mount Carmel," 1:4:5, pp. 125-126.

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The Kingdom of God as Relation

Amelia Nan Langston

The author describes the theory of an emerging interdisciplinary field called 'ecological science,' the study of which leads to innovative ideas about the nature of God.

Science and theology have long been blood-brothers, and they have feuded as only close relatives can. While each has longed to claim a primacy of vision and truth for itself alone, theology based upon sacred texts and revealed truth, and science upon doubt, procedure, and discovery, they have always shared a fundamental belief about the nature of reality--a belief in the ancient Greek philosophical notions of perfection. They have shared a search for the immutable, the unchanging, the first cause, the unmoved mover, the Theory of Everything, the Mind of God. The first scientists were frank about their search for God in the laws of the universe; somewhere there were regularities to be discovered, rules that God had put in place when creating the universe, rules that still governed. Knowing these laws would provide the solid basis for a moral human life. God as the Good, the first cause, the unmoved mover is familiar in theology, and much thought has been devoted to ferreting out this God through the judicious use of logic and elimination--God must do good and not evil, for instance.

However, recent changes in science question the very existence of perfect, unchanging essence. Critiques of the traditional scientific quest for essential truths propose a very different metaphysical vision, one based upon process and relation as formative and fundamental. This "ecological" science prompts us to reread the scriptures with different assumptions in mind, and to notice that Jesus said, "The kingdom of God is among you."[1]

Theology has sought to define how God must be, while science has sought God in the natural world, basing the search upon theological ideas of God. Many of the defining characteristics of God have been rooted in ancient Greek philosophy. The goal of the early Greek philosophers was to "account for all natural phenomena in terms of a few simple substances or principles."[2] These substances or principles had to adhere to the Greek notions of perfection; they had to be unchanging, transcendent, and immutable. Plato developed a notion of Forms, which sees the material world as a shadowy and imperfect realization of a spiritual ideal. This spiritual ideal must represent the perfect essence of its material realization, thus it must be unchanging, immutable, timeless. This philosophical frame of reference was picked up by early Jewish and Christian theologians such as Philo of Alexandria and Augustine, and so on into modern theology and modern science.

The Jewish theologian Philo (d. c. 50 C.E.) wedded Greek philosophy and Hebrew religion to develop a doctrine of God as pure being, as the First Principle.[3] Augustine of Hippo (5th c.) later made similar claims--that God must be pure being, immutable and unchanging.[4] David Pailin points out some of the problems with the logical progression of these ideas about God in theology. According to Pailin, both Anselm (11-12th c) and Aquinas (13th c) conceived a God that cannot relate to or be affected by creatures, for to do so would be to compromise the divine perfection and immutability.[5] This quest for the essence, or essential

definition, of God continues to the present day. The problem with this endeavor is that in the search for God's essence, God must immediately be made finite and bounded by human rationality. God must be good and not evil, unmoved but capable of setting in motion. Paul Tillich, for example, attempts to unbind God by defining Deity as both being *and* non-being; and yet he still weights being, equating it with goodness.[6] Science, in seeking the mind of God in the natural world, has been plagued with these same assumptions about God.

Early science sought to discover the laws and universal principles that God put into place when creating the universe. As such, the laws and universal principles that science would uncover must necessarily reflect the same paradigm as God's own self; they must be unchanging, universal, perfect, and true. René Descartes laid down a paradigm of proper knowledge in his *Discourse on Method and Meditations on First Philosophy*, unconsciously using these same categories. Descartes hoped that by using a system of radical doubt and skepticism, and by applying all "ideas"[7] to that doubt, one could discover things that one could not doubt, and these ideas could then be considered to be true. His methodology consisted of breaking down ideas into their component parts, testing the parts for truth, and then rebuilding the idea. An idea with true parts must as a whole be true--much like a machine, whose component parts must have integrity for it to function.

Even though he had developed a concept and methodology of radical doubt, there were many fundamental assumptions about the nature of the world that Descartes did not question. Descartes assumed that there were indeed fixed laws, put in place by God at creation: that matter is inert and dead, quickened only in human beings by the God-given rational soul, and that God had combined objects in the natural world into stable and predictable systems.[8] This model sees a world that functions as a machine, and that can be understood as such. It assumes that the existence of discrete entities that interact in a linear fashion, and that by discovering these entities and their interactions, one can successfully predict and thus control the future.

Two centuries after Descartes set forth the basic principles of science, Thomas Huxley, natural scientist and friend to Charles Darwin, struggled to realize a comprehensive scientific model of knowledge based on the world-as-machine model. Huxley, in his *Essays*, felt that the paradigm of the machine could be applied to all areas of study in the natural sciences. Once one had determined the laws and principles that moved the machine, one would have discovered the mind of God and would have a basis for moral action, for nature "is creating a firm and living faith in the existence of immutable moral and physical laws, perfect obedience to which is the highest possible aim of an intelligent being."[9]

Worldviews are subject to change, however. Thomas Kuhn, in *The Structure of Scientific Revolutions*, claims that when current theories and models are found to be inadequate and are subject to repeated and systemic theory failure, a revolution in scientific thought occurs.[10] The Cartesian world-as-machine model has come to be seen as inadequate to describe the world. This revolution began first, perhaps, with physics and Heisenberg's Uncertainty Principle, which states that the more accurately one measures a particle's mass, the less accurately one can measure its

What I will call ecological science encompasses many theories, such as chaos, bifurcation, catastrophe, complexity and hierarchy, as well as feminist post-modern critiques of traditional science.

speed.[11] This principle states that perfect knowledge in one area precludes it in another, and thus overturned the possibility of determinism and certainty at the smallest level, bringing the Cartesian worldview into doubt. Ecology, as a science based upon systems rather than discrete entities, is a more recent challenge to the traditional scientific model, questioning the basis for reductionism, linearity, and cause-and-effect models.

Recent critiques of traditional science range across a spectrum of the degree to which they disagree with Cartesian definitions of reality. What I will call ecological science encompasses many theories, such as chaos, bifurcation, catastrophe, complexity and hierarchy, as well as feminist post-modern critiques of traditional science. These theories, or sciences, are ecological in that they seek to understand systems of relation and process, rather than discrete entities or universal principles. Upholders of theories such as chaos, complexity and hierarchy, however, seem more inclined to accept the existence of an external reality, while feminist, post-modern critiques maintain that we create the reality that we seek to explain. They diverge in that sciences of complexity focus on new ways of doing *science*, and post-modern critiques focus on new ways of *doing* science. Both, however, see relation and process as fundamental realities, and it is that realization that differentiates them from traditional science.

Chaos, complexity, and hierarchy are interrelated theories that state that the world is made up of systems that are inherently unpredictable (chaos), irreducible and nonlinear (complexity), and which, therefore, must be explained with limited and contingent theories that are relevant only for a particular scale or situation (hierarchy). There are several techniques or theories that deal with unpredictability--bifurcation, mathematical chaos, and catastrophe. They all deal with phenomena of change, and with the inherent indeterminacy of system function.[12] These theories maintain that systems are naturally chaotic and unpredictable, rather than being stable, as a Cartesian framework assumes. For that reason, they are interested in process and the evolution of systems, seeing change as a fundamental reality. Thus, an essential aspect of chaos theory is that the complex interactions that arise in systems cannot be extrapolated back in time, or back to a first cause; predictable linearity does not hold.

Complexity states that a fundamental reality of systems is that they are complex, *i.e.*, nonlinear and irreducible. Non-linearity has to do with unpredictability and organic process. Systems or entities do not march forward in a simple, cause-and-effect pattern; there is no determined or inevitable end to any set of interactions. Instead, there are feedback loops, self-regulatory mechanisms, unknown and indeterminate interactions, phase shifts to new levels of stability. 1+1+1 may equal 1, or it may equal 57, or the whole system may shift and negate the frame of reference that defined the 1. For example, if one looks at climate change as a simple, linear system, the temperature of Earth should increase incrementally as the level of greenhouse gases in the atmosphere increases (if the greenhouse theory is correct). Recent findings indicate, however, that marine algal blooms, caused by nutrient-loading from sewage and agricultural runoff, as well as warming ocean waters, make a waste product, dimethyl sulfide, which may seed cloud formation, increase the albedo effect, and decrease Earth's temperature. Such feedback loops are an intrinsic part of self-regulating organic systems, and they render linear frameworks useless for understanding, much less for prediction.

Irreducibility is another facet of complexity and non-linearity. Irreducibility holds that the sum is greater that the parts. Thus, a system cannot be broken into its individual parts and put back together through linear logic, as Descartes assumed was possible; nor can individual organisms be abstracted from their communities and contexts as representative of the whole system. For instance, Stephen Jay Gould maintains that variation in populations and

change over time are the reality; one cannot reduce "horses" to "horse," for example, and have an understanding for the present, past or future. The range and variety of horses within their environments has scientific meaning and validity, not the concept of the essential horse, abstracted from relation to environment and dynamic change.[14] Theories, as well, cannot be reduced to one theory that can explain everything. Stewart and Cohen show that even with a Theory of Everything (TOE) established within a very simple, rule-based logical universe--a computer program, for instance--chaotic circumstances arise which the TOE cannot explain or predict.[15]

Hierarchy serves as a theoretical justification for the patchwork of theories and explanations that arise out of complexity and chaos. Hierarchy theory maintains that reality is made up of interconnected levels that cannot be reduced to, and understood at, a more basic level. One cannot abstract a single individual and hope to explain a community or society from that person, nor can one theoretically explain the biological progression from a single cell to an individual human being. Theories must be located within a particular hierarchical level, and the findings will be relevant for that level only. Two different hierarchical levels probably cannot be described or explained by the same theory, and no universal theory can exist to make sense of phenomena.

The fundamental assertion within this systems mode of thought is that, unlike Newton's interacting bodies that remain unchanged by the interaction, individuals do not exist as discrete entities. Instead, in an ecological science, entities are seen to be formed by their relations--to their environments, to other entities, to their pasts. As O'Connor points out:

> In the view of complexity, the properties that an element displays are not deemed intrinsic and immutable to the observed 'object' itself. Rather, the discernible components together with their properties 'emerge' and are manifest within a collective regime of activity. Objects and properties are the co-effects of the totality of their interactions. A given element can only be understood in terms of its inter-being with the rest of what is (which is, in the first approximation, the object's environment).[16]

This kind of understanding changes the nature of science itself. The traditional goal of prediction and control must give way to respect for the integrity of systems, for variation, and for diversity. The inherent unpredictability of reality, rather than being a stumbling block, can be seen as the vital signs of a living system. As O'Connor says, indeterminacy points us toward better theories and questions about the world.[17] The prediction and manipulation desired by traditional science is a dead system of control, not a living conversation with dynamic phenomena.[18]

These criticisms are carried a step farther by feminist thinkers who use post-modern concerns about the nature of objectivity to question the execution of science, as well as the responsibilities of scientists themselves. Ina Wagner and Elisabetta Donini both call for a contextualization of science and scientists, and an integration of science into the responsibilities of process and relation.

Ina Wagner is concerned about the performance of science by its practitioners. She sees the need for scientists to work in context and in responsible relation to the world. From this perspective, she criticizes the concept of objectivity, which she claims allows scientists to evade responsibility for their work by pretending that the scientific question and answer were both inevitable, existing independently of the scientist.[19] The tendency to abstract, and to work in simulations of reality, encourages the attitude that science is a game, that all is permitted, and that social norms, therefore, are suspended. Scientific inquiry does not encourage its practitioners to seek out the difference between model and reality; effort is focused on the medium--the conceptual tools and methods. The problems of objectivity and abstraction remove the scientist and scientific endeavor from a sense of responsibility, accountability, and meaningful location within a world of very real issues and problems. Wagner suggests

several methods for scientists to recontextualize themselves and their work, which involve being aware of the political and technological implications of one's work, and of the assumptions and paradigms under which one works; such awareness can help with the important task of making one's work accessible to people outside one's own field. Wagner's critique is useful in bringing a sense of responsibility and accountability into scientific practice.

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Elisabetta Donini, however, takes this critique farther in questioning the very paradigm of science itself. Donini denies the existence of objectivity as well, seeing male subjectivity as "embedded in the very structure of objectivity ascribed to science" and, therefore, also calling into question the inevitability of scientific values and valuations.[20] For Donini, however, the ability to question objectivity, and thus the presumed necessity of doing science in a particular "objectively correct" way, opens a path for new ways of thinking about science. Donini and her colleagues in Italy used the problem of radioactive fallout from Chernobyl to propose a new scientific ethic. Instead of the "male-biased aims of building up more and more sophisticated technological systems, in an endless challenge to subjugate natural forces," Donini proposes an "awareness of limits" and a sense of being within the processes and relationships of the natural world. This "location internal to process" changes the focus of science from the ends to the means. Good process means good relation and, thus, desirable ends.

These critiques of science offered by chaos, complexity, hierarchy, and feminist post-modernism question the ancient Greek philosophical notions of truth and perfect knowledge as being immutable, universal, unchanging, and transcendent. Ecological science locates truth in process and relation, rather than in objectively discoverable principles, or definable entities. The concept of natural law in science--the desire to locate God in the workings of the universe--seems a valid way of understanding ourselves and our relation to the divine, since we are certainly an important part of the natural world. However, it is unlikely that the God we discover there will be immutable, unchanging, or perfect in any philosophical sense.

Jesus said "The kingdom of God is among you."[21] If we can find God in the process of relation, perhaps we can indeed dwell in a kingdom of God. What ecological science points us toward, however, is an awareness that this kingdom is not only peopled by human beings, but must be made up of the entire natural world. Complexity theory proposes the emergence of entities from relations, and so emphasizes our ability to affect and create our world, while indeterminacy and chaos underscore our inability to control it. This realization makes human beings responsible for right relation, which is all we can do, for control is forever out of our reach. Perhaps in means that are respectful of other creatures and Earth, the kingdom of God can be created and the ends will take care of themselves.

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Endnotes:

[1]Luke 17:21.

[2]Stead, p. 4.

[3]*Ibid.*

[4]*Ibid.*, p. 223.

[5]Pailin, pp. 144-145.

[6]See Tillich.

[7]Ideas, for Descartes, were the mental representations of all things--perceptions of emotions, people, trees, animals, heat, cold, mathematical principles. All of these things could be known only through their mental representations--as an "idea," and another person was as open to doubt as an emotion or feeling.

[8]Toulmin, pp. 110-115.

[9]Huxley, p. 45.

[10]See Kuhn.

[11]Hawking, p. 55.

[12]See O'Connor.

[13]See Tester.

[14]See Gould.

[15]See Stewart and Cohen.

[16]O'Connor, p. 612.

[17]*Ibid.*, p. 614

[18]Cheetham, pp. 293-311.

[19]See Wagner.

[20]See Donini.

[21]Luke 17:21.

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Thomas and Damasio in Dialogue

William C. Mattison, III

The author looks at the role of human emotions in decision-making. After noting the weakness in the Kantian view of morality, he examines Thomas Aquinas's ideas concerning the place of the passions in moral agency. Finally turning to Antonio Damasio's interpretations of contemporary neurological research, he finds support for Thomas and new opportunity for fruitful dialogue between theology and science.

The relation between reason and the emotions is not often treated in Christian moral theology. Because moral theology has traditionally been concerned with the assignment of praise or blame for human actions, the will has been the subject of closest scrutiny. Surely this discipline may be expected to continue to focus on the will; however, underlying such a concentration on the will, often may be found a set of assumptions regarding reason and emotion. In the exercise of the will, the moral agent is encouraged to heed the guidance of reason, and be wary of the unpredictable and often adulterating influence of the emotions. When considering an ethical decision, one is warned, "Don't be so emotional! Be reasonable about this!" Emotions are viewed as unreliable, untamed impulses that interfere with the "cool" precision of reason.[1] Reason, on the other hand, is seen as the impartial judge that enables a moral agent to weigh alternative choices prudently before selecting the most morally acceptable. Consequently, theologians of the past have been, at best, wary of the role of emotion in the moral life. The most notorious example of such a view is that of Kant, who insisted that any moral action, in order to be considered such, must be performed purely out of duty.[2] Any other motivation rendered that action morally meaningless. One imagines the Kantian ideal moral agent as some sort of automaton, coldly moving through life, making passionless decisions out of duty.

Surely a better understanding of living a moral life is needed. Moral theology, or Christian ethics, considers not the immanent essence of God, but rather how people in relation to God can make that relation the defining element of their life. Such treatment always implicitly reveals something about God. To understand how human emotion can be most properly understood as part of that moral life, theologians would be best served by knowing how emotions function in the person from the perspective of biology, psychiatry, and psychology. The purpose of this paper is to contribute to that dialogue between theology and the sciences. It will focus an the relationship between reason and the emotions as understood by Thomas Aquinas and by contemporary neurologist Antonio Damasio. Two preliminary topics, however, must be addressed prior to that discussion. First, a brief description will be offered of how dialogue between theology and science has progressed to the present, having paved the way for current work. Next, a central theological issue, the relation between nature and grace, will be adduced as a cornerstone to this dialogue.

A comparison of Thomas with a contemporary neurologist may appear odd. Yet, perhaps due to his knowledge of Aristotelian naturalistic philosophy, Thomas's theological system is quite thorough in its elaboration of human anthropology, and it directly addresses this issue of the relation between reason and the emotions. While describing "man and his acts"[3] in the

Secunda pars, Thomas is far more nuanced as to the role of emotion in the moral life than the above caricature of Kant's thought. Damasio's work will be offered as a correction to, yet far from a dismissal of, Thomas's vision. In fact, it will be demonstrated that the majority of Thomas's work on the emotions is quite compatible with modern scientific research. Understood in tandem, as partners in dialogue, Damasio and Thomas present a vision of the role of emotions in the moral life that satisfies the concerns of both theology and science in their convergence on the truth.

Understood in tandem, as partners in dialogue, Damasio and Thomas present a vision of the role of emotions in the moral life that satisfies the concerns of both theology and science in their convergence on the truth.

As stated above, this dialogue is already well under way. Earlier in this century, Alfred North Whitehead melded his work in mathematics and in philosophy to form a vision that has engendered the process approach to theology. This work continues today through such authors as John Cobb and David Griffin. In "Philosophy and Philosophising in Theology," Karl Rahner claims that theology's new partner in dialogue in the age of pluralism should be the sciences, as opposed to philosophy. He asserts that theology is concerned with humanity's history and future--not as things, but as created by humanity.[4] While philosophy can consider history and the future only in a formal manner, "the sciences represent history and the future."[5] Paul Davies is a more recent advocate of that dialogue, speaking from the side of the sciences.

One final example of such dialogue offered here is the recent book of James M. Gustafson entitled *Intersections*. In it he explicitly treats the dynamics of the dialogue. He claims that "intersections" between theology and science have thus far been primarily one-way streets, with theology serving as informer of the "Godless sciences." Gustafson finds three reasons behind this dynamic. He cites religion's common claim to special authority by divine revelation. He notes that theology often claims a more comprehensive approach in matters of ultimate meaning. Finally, he states that theology often claims a privileged place in such dialogue, because the most important issues in the sciences are viewed as primarily theological and, hence, best left up to theological interpretations and approaches.[6] A fine example of these approaches is the realm of bioethics, into which religious ethicists may tread with little or no understanding of the medical and biological reality defining the situation.

Yet Gustafson is dissatisfied with these approaches. He prefers an intersection between theology and the sciences with two-way traffic. In this scenario, theology still "has a claim to be heard"[7] as much as other disciplines. Yet theology and ethics also have a responsibility to be informed by contributions from other fields of inquiry in their "descriptions, explanations, and interpretations of the human."[8] It is this model which is supported and utilized in this essay. It rests on a foundational theological assumption, the subject of the second preliminary remark.

Science is concerned primarily with the natural, and it can neglect the divine (and has often done so). Theology, on the other hand, is concerned especially with the divine, yet cannot neglect some treatment of nature in that vision. However, understandings of the natural order can vastly vary. Some may view the natural realm as worthless and decrepit, and focus solely on the world to come. Others may see it as divinely created and sanctified, albeit incomplete. Those involved in the dialogue between science and theology tend toward the latter position, and Thomas would be a good example. His contention that grace perfects nature is well known. He affirms

Dionysius when he says, "it belongs to Divine providence, not to destroy but to preserve the nature of things."[9] His treatment of the order of love confirms that Thomas views divine agency as operative not against, but within and through divinely created nature.[10] Such an understanding of the relationship between grace and nature is crucial to this inquiry. It is here assumed that knowledge of God, or especially knowledge of how people in relation to God are defined by that relation, can be gleaned from analysis of divinely created nature. Thomas is surely no "naturalist" in the sense described by Rahner and Vorgrimler, for he does not completely identify the natural with the real.[11] But he may be called a "natural theologian" through his affirmations concerning the natural world, insofar as it is God's creature.[12]

These two preliminary considerations are by no means exhaustive treatments of what are two challenging and complicated subjects. The brief discussion of theology and science in dialogue is not meant to be a comprehensive account, nor an appraisal of the validity, of the specific work mentioned. It is merely an indication that some sort of dialogue is extant, and that the comparison below is not as odd as it might initially seem. The even shorter discussion of the relation between nature and grace barely scratches the surface of that topic. Yet it will hopefully remind the reader of instances in the Christian tradition where knowledge of the divine-human relation is gleaned from inquiry into the divinely created natural order.

Damasio offers one such attempt in *Descartes' Error*. His explicit purpose is not merely the re-articulation of the relation between emotions and reason. Yet it is a necessary starting point in elaborating his main thesis, the conception of an embodied mind (as opposed to "em-brained" mind), which will not be discussed here. He attempts to demonstrate that reason can never be "pure," in the sense of "emotionless." He argues that while an overly emotional person may reason poorly, so too will the nonemotional person. This argument is obviously relevant to any judgment of Kant's understanding of morality.

Damasio's methodology combines experimentation and theory. He begins by describing several cases, briefly treated here, to add clarity to his conclusions. Two patients, Phineas and Eliot, suffered from similar disorders, and their cases will be described simultaneously. Both sustained major damage to portions of the frontal lobe of the brain. Amazingly, the damage spared all cognitive, motor, language, and sensory abilities. The victims could speak, move normally, and solve problems.[13] However, they were still irrevocably changed. They are described as fitful, irreverent, impatient with things that conflict with their immediate desires, capricious, vacillating, and lacking any effective future planning. They seemed to show no responsibility for themselves or others. It seemed they had lost something uniquely human."[14]

Science is concerned primarily with the natural, and it can neglect the divine (and has often done so). Theology, on the other hand, is concerned especially with the divine, yet cannot neglect some treatment of nature in that vision.

As doctors continued to test for intellectual defect, they noticed the patients' surprising lack of emotion. Eliot is described as totally neutral about everything. He could recite the circumstances of his illness as a completely disinterested observer. Eliot even mentioned at one point that he didn't "feel" things emotionally as he had before his illness. Damasio elaborates on the brain structures that were damaged, noting their instrumental role in human emotion. Both astonished and horrified, he asks his readers to imagine being intellectu-

ally aware of something, and even cognizant that it once roused them, yet to feel absolutely nothing regarding it. Such was life for Phineas and Eliot.

Regarding the implications of these findings for the moral life, the results of several batteries of tests showed that Eliot was indeed aware of ethical guidelines, and would even choose the "morally right" solution in the laboratory setting. He could retain, learn, and apply ethical norms, yet never in the outside world. Neither patient was able to hold a job, make simple decisions, or maintain familial and other interpersonal relations. Apparently "some part of the value system remains, and can be utilized in abstract terms, but it is unconnected to real-life situations."[15] Once, upon finishing a set of such tests, Eliot, completely devoid of emotion, remarked, "After all this, I still won't know what to do."[16] In this he was wrong: he knew what to do, yet could not act on that knowledge.

Damasio concludes that "*reduction in emotion may constitute an equally important source of irrational behavior*" (emphasis in original).[17] He claims that "pure reason" is an inadequate view of decision-making. People simply do not imagine all possibilities, weigh them rationally, and select the most reasonable option. Besides being wildly inefficient, such an approach would fail to "move" the agent toward appropriate choices. And so he posits a "somatic marker hypothesis" to explain how people make choices. As a person envisions different scenarios, he or she experiences bodily ("somatic") feelings toward them, which then "mark" that scenario. The person still rationally weighs alternatives, yet the emotions contribute to, and maximize (rather than replace), the efficient use of reason. Reason alone cannot cope well with the complexity and uncertainty of life, and thus requires special assistance.[18] Emotions are essential in the assignment of basic value, and provide that assistance.[19] Paraphrasing Pascal's famous maxim, Damasio says, "*the organism has some reasons that reason must utilize*" (emphasis in original).[20]

One may begin to wonder what any of this has to do with Thomas Aquinas or even with theology. The intent here is not to confine moral theology to the field of cognitive psychology. Nor is the richness, complexity, and challenge of the moral life to be "explained away" with a biological account of the interplay between reason and the emotions. Certainly the moral life is not to be equated with the ability to hold a job or to recount an experience emotionally. Moral theology and neurology ask different questions, utilize different methodologies, and arrive at different forms of solutions. Yet both investigate the human reality, and surely there are intersections between the impact of the emotions on reason and the attempt to live a moral life. So, while the moral theologian need not grasp the intricacies (or even rely on the validity) of the somatic marker hypothesis, that theologian may allow an abundance of empirical evidence to impact the understanding of the role of emotions in the moral life.

With this purpose in mind, a brief description of Thomas's understanding of the relation between reason and the passions is offered to further that dialogue. Thomas directly inquires as to the goodness or badness of the passions (*i.e.*, emotions) in I-II, 24, 3. A thorough analysis of this article, and those that support its presuppositions, will reveal Thomas's view on this question.

In article three Thomas claims "man's good is founded upon reason as its root." Earlier in the work he has established a systematic vision of humanity in relation to God, who is the final end and greatest happiness for humanity. Reason is the faculty that specifies actions that will lead humanity to this end.[21] While reason is humanity's greatest (natural) asset on the path toward God, Thomas immediately asserts in article three that the human "good will be all the more perfect, according as it extends to all things pertaining to man." He seeks an integration of all that is human, when describing humanity's greatest good. All that is naturally and uniquely "human" is subject to the command of reason. The next logical question, then, is whether the

passions are subject to the command of reason. The answer to this question will reveal both the moral quality of the passions, and how (or if) they are related to reason.

Thomas had already addressed this topic in I-II, 17, 7. In that article Thomas reminds the reader that the passions are part of the sensitive appetite. "Now it must be observed that the sensitive appetite differs from the intellective appetite, which is called the will, in the fact that the sensitive appetite is a power of a corporeal organ, whereas the will is not." For Thomas, the passions are firmly embodied. As such, they are not "wholly subject to the command of reason," since the "condition or disposition of the body is not subject to the command of reason." However, to the extent that any act of an appetite follows apprehension (which is regulated by reason), an "act of the sensitive appetite is subject to the command of reason."

Thomas recognizes the valid role of the passions in the moral life. They prompt the person toward morally good actions. Yet he considers their "input" morally appropriate only after reason has "decided" on the right way to act. The impact of emotions before or during that decision can only diminish the moral goodness of an act.

Where does that leave the passions? Considered in themselves, there is no moral good or evil in the passions.[22] Yet if they are "subject to the command of reason," there is moral good or evil in them.[23] That leaves the passions in a "twofold relation to the judgment of reason."[24] Antecedently, the passions "obscure the judgment of reason" and, hence, diminish the moral quality of an act. Yet consequently, the passions can cooperate with the judgment of reason and help a person work "more promptly" toward the good. In this sense the passions increase the moral quality of an act. For "it belongs to the perfection of moral or human good, that the passions themselves also should be controlled by reason."[25] Thus Thomas recognizes the valid role of the passions in the moral life. They prompt the person toward morally good actions. Yet he considers their "input" morally appropriate only after reason has "decided" on the right way to act. The impact of emotions before or during that decision can only diminish the moral goodness of an act.

Though employing quite different language and methodology, clearly the thought of Damasio enjoys intersections with that of Thomas . First, some similarities. Both thinkers view reason as crucial in making moral decisions. For Damasio, it weighs somatically marked alternatives (though to describe its role separates reason from emotion too distinctly in the process). For Thomas, reason is the final human criterion of goodness. Both also claim that the moral life is inadequate without the involvement of emotions. For Thomas, the person who possesses the human virtues might be called "passionately reasonable." Damasio might call such a person an "emotional reasoner." Both paradigms are vastly different from the Kantian model, and unfortunately neither accurately describes Phineas or Eliot.

Yet there are subtle differences between the two paradigms, as should be apparent from the above descriptors. Whereas Thomas's paradigm is a reasonable person with passion, Damasio's person is emotional before using reason. In other words, the passions have only consequent moral value for Thomas. In fact, antecedently they "obscure" reason and "diminish" the moral quality of an act. This is far from the case for Damasio. While not wanting to make emotion the sole determiner of ethical action, he certainly proposes a crucial role for emotion before the use of reason. In fact, he claims that reason cannot function in

the real world without such emotional predispositions.

Another point on which they diverge is the assignment of value to choices. For Thomas this is solely a matter of reason. Yet for Damasio, the emotions must also be involved in that process. Emotions add a value to a choice that somehow moves the agent to act toward that option.. (Recall that Eliot could never act on his accurate knowledge of ethical convention.) Thomas indicates a possible openness to such a role for the emotions in I-II, 24, 4 ad. 2, when he mentions certain passions as having material goodness in themselves. Yet in the end, emotions for Thomas must remain firmly subject to the command of reason. He even claims that one way in which passions arise consequently is by an overflow from a strong will![26]

Thomas offers an account of the passions that gives them an important role in the moral life. Yet his account is inadequate in its overemphasis on the primacy of reason during moral decision-making. Were it adequate alone, Eliot and Phineas would be able to live moral, albeit passionless, lives. Yet Damasio's work demonstrates that reason alone does not compel one to act morally.

Contemporary theologians would benefit from drawing on Thomas's largely accurate work on the passions, along with some correction from recent neurobiological research, in order to construct a vision of the moral life in which the emotions enjoy their proper role. This paper is obviously only the beginning of that task. Several issues are yet to be addressed. For instance, moral theologians today tend to elaborate an "ethics of being," or even a virtue ethic, approaches not treated here. It is supposed that such demonstration of the necessity of emotion in an act-based ethic would make that task easier. Perhaps Thomas's moral virtues would result in passions that could antecedently contribute to moral decision-making. There are also issues of religious and ethical motivation that are only hinted at here. Finally, an approach has been chosen here that is more individualistic than would be preferred either by evolutionary biologists or by community ethicists. Future work to broaden the scope of approach along these lines promises to be fruitful, owing to the benefits offered by theology and science in dialogue.

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Endnotes:

[1]Oakley, p. 88.

[2]Kant, p. 13.

[3]Boyle, p. 16.

[4]Rahner, pp. 60-62.

[5]*Ibid.*, p. 62.

[6]Gustafson, pp. 2-3.

[7]*Ibid.*, p. 4.
[8]*Ibid.*, p. 6.
[9]Aquinas, I-II, 10, 4.
[10]*Ibid.*, II-II, 26, 6.
[11]Rahner and Vorgrimler, p. 329.
[12]*Ibid.*, p. 331.
[13]Damasio, p. 8.
[14]*Ibid.*, p. 19.
[15]*Ibid.*, p. 11.
[16]*Ibid.*, p. 49.
[17]*Ibid.*, p. 53.
[18]*Ibid.*, p. 191.
[19]*Ibid.*, p. 197.
[20]*Ibid.*, p. 200.
[21]Keenan, p. 69.
[22]Aquinas, I-II, 24, 1.
[23]*Ibid.*
[24]*Ibid.*, I-II, 24, 3.
[25]*Ibid.*
[26]*Ibid.*

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The Advancement of New Theology Using New Science: The Three Key Concepts of Thomas Torrance

Susan Murtha-Smith

The author begins with a selective outline of historical understandings of the concepts of space and time, in order to demonstrate their import for and engagement with theology. She then procedes to organize the three key concepts in Torrance's thought that are the most significant to the advancement of contemporary theology using insights from "new science."

Theologian Thomas Torrance has shown that the concepts of space and time have been key epistemological instruments of historical theological and scientific paradigms, creating either intellectual-spiritual synthesis or dissonance. Torrance cogently demonstrates that the epistemology of 'new science' has allowed for dramatic advances in its development of 'cognitive instruments' that can discern objective knowledge in a way that is compatible with, and especially constructive for, the task of new theology.

Understandings of space and time: relational finite receptacle, infinite receptacle

Within Greek science and philosophy, space was understood as a 'finite receptacle' or container that delimited matter, thereby making the material world finite and comprehensible. Patristic thinkers argued, instead, that since God created out of nothing, space and time are *rational structures, created with* and *embedded in* nature. They further argued that all of creation--rational and material--is made comprehensible through the divine creative power, not through God's physical embodiment of the universe. Furthermore, since space and time are the bearers of the universe's immanent order, they are the rational media through which God is made known to us in the incarnation. Thus, a concept of space emerged as the seat of relations--ontological and dynamic--between God and the universe, established in creation and brought into its sharpest focus in the incarnation.[1] Thus, it was very much a differential concept, relating creaturely and transcendent rationality.

With the recovery of Aristotelian philosophy and science in the late Middle Ages, there was a return to the finite receptacle notion of space and time and a correlative static notion of God as the Unmoved Mover. However, with the Reformation doctrine of 'grace alone' and the contingency of the world, a new interest was aroused in empirical investigation into the rational world. Aligned with the attempts of Renaissance science to set aside *a priori* explanations and 'final causes,' the notion of space developed as the 'infinite receptacle' of all things. Newton, who embraced this view, understood space and time as attributes of God; that is, he held that God quite literally contains and comprehends the universe in the divine self.[2] Furthermore, as the infinite receptacle of all creaturely matter, God conferred rationality upon nature by causally conditioning material existence.

Newton's scheme carried with it enormous theological and scientific implications. First, absolute space and time were immovable, conceptualizations that brought a return to static notions of God. Also, as fixed frames, space and time were unaffected by what happened in them. This built-in dualism between space/time and matter meant there was no way in which

God (as absolute container) could become incarnate (as content). Indeed, Newton found himself in sharp conflict with Athanasius' notion of *homoousion* and defended Arianism, instead.[3] At the same time, the notion that fixed space and time causally condition material existence (the inertial system) led naturally to a mechanistic view of the universe.[4]

Torrance finds this dualism and staticity, together with the Lutheran view of *finitum capax infiniti*, to be the intellectual roots of Kant's thought. When 'awoken from his dogmatic slumber' by Hume's radical critique of causality, Kant concluded that knowledge arises through the coordination of empirical *a posteriori* elements (synthetic) and *a priori* forms of human understanding that organize these apprehensions. Thus, while Kant was right in attempting to coordinate the theoretical and empirical, Torrance argues that, in effect, he transferred the limiting comprehension of the material universe from God to the human mind ('transcendental ego').[5] Here, in effect, the human mind becomes the (Newtonian) infinite receptacle that makes knowledge possible.

The first implication is that God, who is outside this world, is strictly unknowable, not being an object that can be shaped by human reason. If God is to be known, it must be through some other means. Thus, there arose a radical dualism between Kant's notion of faith's knowledge and reason. The second implication is that, if space and time are *a priori* forms of human perception, then the only God a person can have is one of his or her own appropriation (Christ-for-us) and not one ontologically given.[6]

It is in this conflation of Newtonian, Lutheran and Kantian ideas that Torrance finds the root of the modern Protestant antithesis between God and the world, phenomenal and eternal events, *Geschichte* and *Historie*--that is so problematic for contemporary Christians. Such a conflation was possible because of the shared 'receptacle' notion of space and time, with their epistemological corollaries. Atheism, deism, natural theology, and existentialism were inevitable, says Torrance, because if theology is detached from the ontology established in the interaction between God and the world, it could "only break up into as many theologies as there are theologians."[7]

Newton's scheme carried with it enormous theological and scientific implications. As fixed frames, space and time were unaffected by what happened in them. This built-in dualism between space/time and matter meant there was no way in which God (as absolute container) could become incarnate (as content).

New science and new theology

In Torrance's view, the task of contemporary science and theology is to bring together the ontological and dynamic approaches.[8] Torrance argues that new science has begun to develop the appropriate 'cognitive instrument' for this task and to give helpful clues for accomplishing it. The three chief characteristics of this instrument are outlined below:

(I) The instrument must coordinate rational form or theoretic components and being or material existence. This eliminates dualism or disintegration of imbued structures. (In theology, this coordination is necessary because material existence is imbued with rationality in God's act of creative-comprehension.)

(II) The instrument must be upwardly adaptable, such that it uses one level of rationality and material existence while pointing beyond itself to another level, yet without becoming detached from the lower level. This eliminates reductionism. (In theology, this is necessary because creation and the incarnation provide the ontological ground of our existence while pointing beyond themselves, revealing the truth of God.)

(III) The unity of rational form and being in nature means that our investigation is fused with both components from the start. Thus, true knowledge cannot be:
--known in advance: *a priori* conceptualism of imposing form upon content.
--directly experienced: pure empiricism.
--artificially abstracted: theoretic rationality separate from materiality.

Rather, ontological knowledge is an "experienced imperceptible."[10] Thus, there is *no method* for its discovery; only by intuitively penetrating reality can true knowledge of nature and God can be disclosed.

Before discussing new science and new theology in light of this instrument, it will be useful to review the *methodological* shift from Newton to Kant to new science.

Newtonian Methodology

As stated above, it was during the Reformation and Renaissance that an attempt at an *a posteriori* science emerged. However, as Torrance interprets the matter, Newton's methodology did not fully conform to this agenda. The first scientific contradiction arose with Newton's claim that he was deriving his scientific concepts *empirically*. "Whatever is not deduced from phenomena is to be called an hypothesis," said Newton; "and hypotheses...have no place in experimental philosophy."[11] But, in fact, he contradicted this precept by identifying space and time with the absolute --which, by definition, was completely inaccessible to empirical observation Newton did bring theoretical components into his analysis. The second problem was that these theoretical components were an artificial abstraction of form, separated from interaction with material content, and thus not ontological. Because of Newton's profound success in defining motion, Torrance notes that the scientific world was misled into believing that the scientific process is that of deducing rational laws from sense experience.[12]

According to Torrance then, for two related reasons Newton's approach does not satisfy the challenge of new science and new theology to develop appropriate cognitive instruments. First, form or rational structures must be coordinated with material content (see (I) above), whereas Newton separated them by identifying space and time as entities independent of the material world. Second, while Newton was right in attempting to *discover* form (though he actually imposed it), he erroneously conceived of this as direct empiricism. But as new science shows, rational space and time are fused with matter and energy; rational forms alone are not directly accessible.[13] Following Einstein, Torrance maintains that "while concepts are suggested by experience, they require creative and constructive activity on the part of the human mind for their discovery." They are "experienced imperceptibles" (see (III) above).[14]

Kantian Methodology

With Hume's critique of causality, empirical science had no means of justification. Kant did not challenge Newton's theoretical scheme, but instead found a justifiable explanation for it with his *synthetic a priori*. But, of course, this meant that the intellect does not draw its laws out of nature, but instead imposes its laws upon nature.[15] Correlatively, nature in itself cannot be known. While Torrance affirms Kant's attempt to coordinate the theoretical and the empirical, his notion of *a priori* human conceptuality was erroneous in that it meant empirical knowledge was essentially controlled and not apprehended. It is here that Torrance believes science and theology accepted the notion that form is not something to be discovered (contra (III) above); rather "we clothe the universe with form and structure and thereby give it meaning for ourselves."[16] From this came the rationalistic functionalism (instrumentalism) of the modern mind.

New Science Approach

Torrance argues that new science has begun to develop this cognitive instrument that overcomes the problems of the Newtonian and Kantian models. Below is a summary of his view of what has been discovered using the three essential characteristics of the instrument as outlined above.

(A) Coordination of form and being (rational structures and material existence).

New science shows a world in which *relations between bodies* are just as real as the bodies themselves.[17] For instance, special relativity shows that space and time are not independent, but represent just two different cross-sections of one 'space-time' continuum. General relativity theory shows that space itself is affected by matter, that space affects the movement of matter, and that time is shrunk by gravity. The splitting of this four-dimensional continuum into three dimensional space and one-dimensional time is purely arbitrary and instrumental. Attempts to separate form and materiality necessarily involves artificial construction of an abstraction, such as Newton's geometry of the relations between rigid bodies, independent of time--relations derived logically and not ontologically. Such dualisms have been found to be incongruent with reality and, thus, must be set aside.[18]

(B) A flexible instrument that coordinates different levels of existence without confusing them or nullifying lower levels.

An example of this is new science's development of unitary field theory, which attempts to give full weight both to knowledge of countable quantized packets of energy and momentum (particle-like behavior), and to knowledge of field properties of extension in space (wave-like behavior). The newly developed tool of unitary theory enlarges the imagination to perceive a new level of complexity not foreseen in the individual parts. This coordination must put to rest any forms of reductionism, as new science has come to recognize that component parts have no separate identity and can only be understood within their holistic configuration.[20]

(C) An instrument that penetrates into the "experienced imperceptibility" and, through testing, establishes a true ontology.

Now that new science has accepted the unity of form and material existence and put to rest a mechanistic understanding of nature, it no longer attempts naive empiricism, false abstraction and *a priori* conceptualism. Concurring with Einstein, Torrance maintains that there is no logical path to the laws of nature, but "only intuition, resting on sympathetic understanding of experience, can reach them."[21] The true ontology of these 'free concepts' will be established or negated when tested against intelligible nature.

An example is found in relativity theory. This cognitive instrument shows an invariant structure of relatedness in nature, irrespective of any observer.[22] Thus, says Torrance, "the very fact that we can offer various representations, without making any difference to what we apprehend, reveals that it is so objectively deep that it remains invariant to our representations of it."[23] Torrance states, "This 'invention' comes to us from the universe itself and with its astonishing correlation between our human thinking and empirical reality, we cannot think that they might just as well have happened otherwise, for it is thrust upon us as belonging to an intelligible order independent of us."[24] It should be noted that Torrance does not regard this cognitive instrument as final, but rather as "an open and flexible structure used postulationally" as reality is probed.[25]

New Theology

When theology seeks to interpret the incarnation and creation with respect to the questions of space and time, it too needs to develop an appropriate cognitive instrument in accordance with the characteristics outlined above. Below is a summary of Torrance's insights about this instrument for new theology.

(1) Coordination of form and being..

Without the dualism of materiality and rational space-time, or between nature and supernature, there can no longer be a dualism between natural theology and revealed theology. Whatever is revealed about God is done within the created rationalities of space-time and, thus, can only be discerned within them. Revealed theology can no longer be pursued apart from the structures of space and time, lest it lapse into irrationality.[26] In order to develop

an adequate account of creation and incarnation, theology must consider the empirical dimensions in space-time. Analogously, natural theology must be transformed. Historically, natural theology used a method of abstract reasoning based upon sense experience and then attempted to relate that reasoning to God. But new natural theology can no longer be extrinsic to actual knowledge of God; rather, Torrance calls for natural theology as a 'theological geometry' that can articulate the material logic of knowledge of God as mediated within space-time.[27] This overall coordination of materiality and rationality is analogous to the task of new science when it disavowed Euclidean geometry as an *a priori* system independent of materiality, and introduced four-dimensional physical-geometry.

(2) Coordinating creaturely and Divine rationalities without confusing them or nullifying creaturely rationality.

Because of God's transcendent freedom, created rationality cannot be identified with Divine rationality (contra Newton). However, since created rationality is derived from the Divine rationality, we must not think of the incarnation as abrogating the rational structures of this world; rather, the incarnation is to be understood as the freely chosen path of God's rationality.[28] Precisely because there is an axis of intersection between God and the world in creation and the incarnation, they can and must be properly coordinated. Such a non-reductionistic coordination means that natural theology cannot be thought of as complete in itself (since the contingent world cannot explain itself), but only as attaining meaning and cogency when properly coordinated with the empirical conditions of revealed theology.[29]

Thus, to avoid reductionism, ontological knowledge requires asking questions 'in opposite directions' at the same time—in accordance with the nature and acts of God and in accordance with the nature and acts of creation. One possible way of expressing this, Torrance suggests, is to use the model of horizontal and vertical coordinate systems. Accordingly, Jesus Christ is then *the place* in all of space and time where God meets with humanity and humanity meets with God, thus constituting an intersection of vertical and horizontal planes.[30] This is where human beings are opened to the transcendent ground of God that gives humanity its true place, for it relates its place to its ontological ground, so that it is not submerged in relativities of what is merely horizontal. Since this coordination of vertical and horizontal axes relates two different realities, they are not to be thought of as one and the same language. The resultant confusion inevitably leads to breaking them apart entirely; and then, erroneously, they become merely symbolic. Development of these differential languages lies ahead in theology.

Without the dualism of materiality and rational space-time, or between nature and supernature, there can no longer be a dualism between natural theology and revealed theology. Whatever is revealed about God is done within the created rationalities of space-time and, thus, can only be discerned within them.

(3) Penetrating into the "experienced imperceptibility" and, through testing, establishing true ontology.

Since an *a posteriori* approach in science and theology is sought, there are no rules or 'methods' for discovering ontological knowledge. What is required is penetrating into and following what is given.

The truth of findings are determined by correlation. When rationality and being are disjoined, and abstractions are made, theorists then test for inner consistency and coherence in order to ascertain their logical truth or falsity. This is an instrumentalist

and positivist approach to science and its verification, which does not seek to grasp reality in its depth (ontologically).[31] In contrast, Torrance argues, when theorists operate with the unity of rationality and being and penetrate into reality so as to grasp its invariant structures, then reality itself is the ultimate judge of what is true or false, since the concern is for ontic and not logical necessity.[32] For theology, the decisive act of God in the incarnation is that invariant locus for our knowledge of God, which can be discerned only by following God in that spatio-temporal disclosure.[33]

Conclusions

Thomas Torrance's instruments of space and time are profoundly valuable for bringing to the surface the deep inter-relationship between theology, science and epistemology. In the summarization of these relationships for this paper, simplification may shade into falsification of major lines of thought. Torrance's corpus greatly expands upon this intellectual history, but he too may simplify in his attempt to illumine the modern and post-modern struggles with notions of realism and ontology.

Certainly many theologians today have come to recognize the need to move past dualism and reductionism. And yet, few have grasped the deeper workings of a cognitive instrument that can overcome them in the way that Torrance sets forth, nor do they recognize the ontology implicit in doing so. However, Torrance's deepest insight about an instrument that attempts to set aside empiricism, *a priori* conceptual-ism, and abstract rationality, in favor of an intuitive penetration of the deeper ontology of nature and of God, seems a far more utopian vision. Few are gifted with the requisite combination of genius, creativity and faith for such fluid, free and open movement of thought. Most will continue to impose preconceived ideas about God and nature onto theology, as well as to attempt to find logical bridges rather than ontological explanations for reality. It is likely that a multiplicity of theologies will continue to be formulated and evangelized. If Torrance himself has not fully conceived of the cognitive instrument for theology, he can be fully credited with insightfully identifying what it ought to be seeking after; and, therefore, he may have a place among those great theologians he notes as exemplars of his vision--Athanasius of Alexandria, Anselm of Canterbury, and Sören Kierkegaard.

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Endnotes:

[1]*Space, Time and Incarnation*, p. 18.

[2]*Ibid.*, p. 38.

[3]*Ibid.*, pp. 39-40.

[4]*Ibid.*, pp. 38-9.

[5]*Transformation & Convergence*, p. 37.

[6]*Space, Time and Incarnation*, p. 44.

[7]*Ibid.*, p. 48.

[8]While Patristic theology was governed by these approaches, it must be restated today in light of the findings of new science. However, it should be made very clear that Torrance does not suggest that theology derives credibility by conforming to science.

Rather, they are accountable to one another, though science is free to derive its credibility from other parameters, such as functionalism.

[9]Torrance does not separate out these characteristics which, in my opinion, is the cause of much confusion in his otherwise cogent arguments.

[10]*Transformation & Convergence*, p. 77.

[11]*Ibid.*, p. 17.

[12]*Ibid.*, p. 23.

[13]*Ibid.*, p. 77.

[14]*Ibid.*, pp. 77-8.

[15]*Ibid.*, pp. 271-2.

[16]*Ibid.*, p. 6.

[17]*Ibid.*, pp. 44-5.

[18]*Ibid.*, p. 76.

[19]*Space, Time and Incarnation*, pp, 76-7. Torrance's development of this example may be somewhat confused. At points he implies that the two levels that are being coordinated are that of quantum theory and relativity theory. But what is actually being coordinated is the unitary quantum field theory on the higher level of complexity with the two lower level theories--quantum and relativity theories.

[20]For instance, a helium atom cannot be understood as having distinguishable parts that can be individually analyzed and built up so as to the predict the behavior of the whole atom.

[21]*Transformation & Convergence*, p. 78.

[22]*Ibid.*, p. 273.

[23]*Ibid.*, p. 275.

[24]*Ibid.*, p. 274.

[25]*Ibid.*

[26]*Reality and Scientific Theology*, p. 36.

[27]*Space, Time and Incarnation*, p. 70.

[28]*Ibid.*, p. 67.

[29]*Reality and Scientific Theology*, pp. 41, 60.

[30]*Space, Time and Incarnation*, 75.

[31]*Reality and Scientific Theology*, pp. 54, 75.

[32]*Ibid.*, p. 50.

[33]*Space, Time and Incarnation*, p. 68.

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This essay was awarded an Honorable Mention.

God, Neo-Symbiosis, and the Unlearning of the Social Darwinist Narrative

Josh Pawelek

The evidence for symbiosis as a mechanism in evolution suggests that nature is not only competitive in the Darwinist sense, but also inherently creative and cooperative. The author grounds the concept of God's transformative power within this scientific mechanism of symbiosis, and argues against competition as the dominant social metaphor.

> Our age is retrospective. It builds the sepulchres of the fathers. It writes biographies, histories, and criticism. The foregoing generations beheld God and nature face to face; we, through their eyes. Why should not we also enjoy an original relation to the universe? Why should not we have a poetry and philosophy of insight and not of tradition, and a religion by revelation to us, and not the history of theirs?
>
> --Ralph Waldo Emerson

This essay tells a story about God. Specifically, it is a story about how science changed peoples' understanding of God's role in history; how the interpretation of scientific evidence forced God out of history; and how new scientific evidence can open the way for God's return to history. This is an interdisciplinary story. First, it tells history, because people learn the most meaningful lessons about themselves, when they encounter their own history. Second, it discusses science, because we live in an age when it is perilous either to accept or deny completely what science teaches. Finally, it explores religion, because, in the act of theological reflection, we can discover for our age what Emerson sought for his: revelation *to us*. These three disciplines do not appear in any particular order. They interact with each other throughout the essay, which is how they must interact in our lives if they are to teach us what it means to be fully human.

We tell history less to know the truth about what has happened, and more to articulate what we believe is true about ourselves. This species of history that lies at the borders of mythology involves artistry and politics. An artistic endeavor, the telling of history seeks a deep understanding of the human condition. What does the past tell us about ourselves and our way of life? In answering these questions, history becomes metaphor, appealing to our innermost passions and values. Yet, as politics, history serves the often hidden purposes of the historian. Factual evidence is filtered through the historian's interpretive lens, so that the past appears to validate the present, when in reality, present conditions have been used to construct the past. Our great historical narratives inspire us to think boldly and creatively, and simultaneously enclose us in the social and cultural systems they uphold. History's drama brings us dangerously close to the precipice beyond which chaos reigns, and then calls us back to safety--to order.

Christian salvation history is one such narrative. For more than 1,700 years, from the time the New Testament was written, its message that God acts in history was the dominant narrative for Western society. The Luke-Acts composite is the New Testament's most cogent telling of this narrative. It divides history into three epochs. First, the time of the law extends from God's creation of the Earth, and foreshadows the coming of Christ. Second, the brief time of Jesus witnesses to God's fundamental revelations: the incarnation and resurrection of Jesus Christ. Third, the time of the Church extends from Christ into

the historian's present, and makes God's revelation manifest in the Church's activities. Most versions of the salvation narrative foresee an end to time, when Christ shall return to Earth to reign in eternal glory. This narrative's artistry is its capacity to impart a sense of meaning and historical destiny to its audience. Its politics aim at upholding the authority of Church and Bible. It gives Christians the freedom to experience God's love, while simultaneously providing parameters for the experience. It intertwines science, history and religion into one homeostatic system. Science serve the intellectual needs of religion and history; history explains the meaning of worldly events in terms of divine providence; religion is the source of highest authority for interpreting history and science.

The 1859 publication of Charles Darwin's *The Origin of Species* completed what the Enlightenment had begun: the elevation of science, the removal of God from history, and the unwriting of the Christian salvation narrative. Darwin's scientific claims did not dismiss God outright. He allowed that a Creator may have breathed life into a few original organisms; but from then on, natural selection was the sole creative mechanism.[1]

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Evolutionary time replaced Biblical time. Darwin's conclusion that it might require a thousand generations for one species to produce two well-distinguished varieties was ominous: clearly, the world had been around much longer than the Bible indicated. "The mind," said Darwin, "cannot possibly grasp the full meaning of the term of even a million years."[2] Darwin removed God from creative proximity to humanity by articulating the sheer expanse of time that had passed between the beginning of life and the beginning of humanity. God may have been present in the beginning, but had been replaced in history by natural selection.

Evolution's implications for the future were also devastating to the principles of salvation history. Where Christians had envisioned Christ's eschatological return to Earth, Darwin saw only uncertainty:

> Of the species now living very few will transmit progeny of any kind to a far distant futurity...for the greater number of species in each genus...have left no descendants, but have become utterly extinct.[3]

Humans would not necessarily recognize themselves in the future; nor could they legitimately claim to have a future. One thing was certain: in this narrative, Christ was not coming back. "Thy kingdom come" was still a powerful theological petition, but it carried no historical significance in the new scientific reality.

The disappearance of God from history went hand in hand with the decline of Church authority and the rise of secularism. In this context, Darwin's followers formulated a new narrative for Western society: *Social Darwinism*. Although Social Darwinism wore the cloak of science, Darwinian evolution proved too bleak an interpretive tool for understanding society; and historical and religious imaginings soon replaced scientific rigor. The Social Darwinists never quite admitted that natural selection occurred over hundreds of generations, or that it referred mainly to the ability to reproduce. Their version of Darwinism assumed that through competition a human being could become highly evolved within one generation. They translated Darwinian science into a dramatic story of competitive human struggle against adversity. Their twisting of Darwin's theory made the science behind it more palatable. The Social Darwinists' artistry lay in their recasting of Darwinism as a socially meaningful story, in which they identified themselves as trium-

phant masters of natural selection. The politics of this narrative lay in its affirmation of society's most rich and powerful members. One's wealth became proof that not only were Darwin's theories correct, but that the wealthy were shining examples of human progress. Those who could not see themselves reflected in this story were regarded as unfit to survive. Social Darwinism thus provided the perfect historical explanation for the rise of big business and free markets, and it became the new scientific rationale for "rugged individualism," racism, economic exploitation, and imperialism.

Natural selection also acquired religious characteristics in the Social Darwinist narrative. British philosopher Herbert Spencer, who coined the term, "survival of the fittest," understood evolution as a moral system. He saw the human capacity to adapt to environmental conditions as synonymous with the capacity for good; non-adaptation was the root of all evil.[4] Nature, he felt, sought to eliminate those who were not morally capable, as they constituted a drain on society's resources. If the poor were not fit to survive, he wrote, then perhaps it was best that they die.[5] In the United States John D. Rockefeller explained evolution as a law of God, while Andrew Carnegie used it to replace his old religion. Carnegie said, "Not only had I got rid of theology and the supernatural, but I had found the truth of evolution."[6] Science, history, and religion--though truncated--had reached a new homeostasis in the Social Darwinist narrative. In this new system, the counterpart for God was a competitive, individualistic spirit who sought to control or vanquish society's weakest members.

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Although Social Darwinism's most ruthless Spencerian form was gone from the American scene by World War I, Richard Hofstadter argued in 1944 that a resurgence of Social Darwinism was always possible, as long as an element of predacity existed in society; scientific critiques of Darwin's theories would have little impact on social thought, because "survival of the fittest" was fixed in the public mind.[7] Today this narrative still resonates deeply in society. We may think "survival of the fittest" is inhumane, but no idea has yet challenged the stability of the Social Darwinist homeostasis. God remains in exile from history, replaced by a compassionless, pseudo-scientific notion.

The scientific basis for a new narrative--one that can bring God back into history--has already been established: *symbiosis*. University of Massachusetts microbiologist Lynn Margulis has been the primary theorist behind symbiosis for more than thirty years. She defines symbiosis as "the living together in intimate association of different kinds of organisms."[8] In studying the microbial world Margulis has shown in a myriad of ways how microorganisms do not always compete for survival; rather, they frequently join together, creating wholly new organisms to meet environmental challenges. The evidence for symbiosis as a mechanism in the creation of species suggests that *Nature is not only competitive, but also cooperative and creative.* Symbiosis thus subtly complements and expands Darwin's theory of evolution.

For an example of symbiosis as an evolutionary process, consider the relationship between eukaryotes and mitochondria. All eukaryotes--organisms with nucleated cells, such as humans, animals, plants, and fungi--depend on mitochondria in their cells to process oxygen and convert nutrients into energy. Interestingly, the DNA in mitochondria is more akin to the DNA of certain free-living bacteria than to the DNA in the nuclei of their home cells. This is evidence that in

our evolutionary past mitochondria were free-living bacteria that, over time, came to merge with nucleated cells, creating the oxygen-processing metabolism common to all eukaryotes today.[9]

Symbiosis is not limited only to such microbial mergers. There are many examples of "intimate associations" in Nature that illustrate symbiosis, such as the relationship between insects and flowers in pollination. This leads to a tempting question: Is the cooperative principle in symbiosis an example of divine revelation in Nature? Not at all. The claim that symbiosis manifests God's actions has been made before, but it is no different than the Social Darwinist search for moral guidance in Darwinian science. Margulis would agree; she is known for her criticisms of those who equate symbiosis with spiritual forces. Nor does symbiosis constitute evidence that cooperation and competition are respectively good and bad; competition is too important a biological force for such a sacred-profane dualism to take hold. Symbiotic cooperation, like Darwinian competition, is foremost a scientific theory that informs us about evolution. We should not succumb to the temptation to see it otherwise.

We encounter God only when we remember that science in the form of basic knowledge is insufficient to account for our whole experience of reality. To learn how symbiosis might inform us about God, we must situate it in relation to history and religion. I call this project *neo-symbiosis*. What narrative would we tell if we interpreted the past in terms of cooperation and creativity rather than competition? How might this narrative intersect with our religious lives? In answering these questions, it is not enough just to tell stories about teamwork. Nobody disputes the value of cooperation, yet Social Darwinist competition remains operative in our lives. Truly to change peoples' attitudes about how best to order their lives, this narrative must self-consciously dismantle the tenets of Social Darwinism, so that a balance between competition and cooperation can be achieved. Such is the task of the neo-symbiotic narrative.

What better way to begin imagining neo-symbiosis than to tell a neo-symbiotic story? It begins with the revolutionary success of antibiotics in fighting infectious diseases. The rise of antibiotics was often described in Social Darwinist terms: humans increased their ability to survive by adapting to an environmental threat. In the process of our adaptation, we demonized bacteria, much as Herbert Spencer demonized the poor a century earlier. However, winning this struggle produced hidden medical costs. In 1953, biologist Helen Coley Nauts noted:

> [N]eoplasms [cancerous tumors] have been observed to regress following acute infections, principally streptococcal. If these cases were not too far-advanced and the infections were of sufficient severity or duration, the tumors completely disappeared and the patients remained free from recurrence.[10]

Similarly, in 1950, M. J. Shear of the National Cancer Institute observed that seventy-five percent of the spontaneous remissions in untreated leukemia at Boston's Children's Hospital occurred following an acute bacterial infection. He went on to ask, "[I]n making progress in the control of infectious diseases, are we removing one of Nature's controls of cancer?"[11] Until now the medical world has never answered this question, because to do so would be inconsistent with its Social Darwinist view of bacteria.

John Pawelek of Yale University has begun to rethink the demonization of bacteria. He offers the following answer to

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the queries of Nauts and Shear: *progress in the control of infectious diseases very likely did eliminate one of Nature's controls of cancer, namely, bacteria.* In an unpublished article, "Tumor-Targeted Salmonella as a Novel Anti-Cancer Vector," he describes his success in using bacteria to suppress growth of human melanoma tumors in mice. Pawelek found that properly engineered salmonella can selectively infiltrate tumors, reproduce, and retard tumor growth. They can also deliver anti-cancer proteins to tumors.[12] As with fire or water, what is perceived as an enemy in one context may be an ally in another. Bacteria can wreak havoc in human bodies, but the Social Darwinist belief in their inherent badness isolates us from their contribution to a larger, healing reality. Though far from complete, Pawelek's work suggests that the human body can cooperate with bacteria--that bacteria symbiotically become part of our immune response to cancerous tumors.

There are three elements that make this a neo-symbiotic narrative. First, there is a lived experience of cooperation and creativity. The story above features cooperation between humans and bacteria, creating the possibility of a new approach to treating cancer. Neo-symbiotic partners work with each other, helping each other, learning from each other. Their act of coming together, whether a physical merger or a sharing of skills or ideas, creates something new: it may be a new organism; it may be a new concept. Note that the lived experience of cooperation does not have to be symbiotic in the strict scientific sense. Symbiosis simply provides the natural model for neo-symbiotic cooperation.

Second, neo-symbiosis locates itself in history. For example, the story above presents Pawelek's work not only in his scientific terms, but as the emergence of a new approach to medical healing, after forty years of Social Darwinist misunderstanding of bacteria. The artistry of the neo-symbiotic narrative lies in its capacity to make cooperation historically meaningful. Its political aim is to problematize Social Darwinism so that some authority is transferred to cooperation. It does not allow us to value cooperation in word and then practice competition in deed. It illustrates how we avoid cooperation at our peril. Although science does not permit us to view symbiosis and Darwinian competition as opposite extremes on a moral spectrum, history takes greater liberties. To make history relevant we must find our moral lives reflected in it. As we move from Social Darwinism to neo-symbiosis, we unabashedly attach moral significance to each, making competition morally subordinate to cooperation. The neo-symbiotic narrative thus gives the comforting sense that history is moving toward cooperation.

Third, neo-symbiosis presents new possibilities in religious discourse and experience. It does so by begging a question that science and history can only partially answer: What is self? For example, are bacteria that can enhance our immune response to cancer part of our self or not? Where Darwinian competition upholds the self, encouraging independence, symbiosis suggests that self is an illusion. It regards self as a composite, a merger of once distinct organisms, and always merging further.[13] To admit that the living self is an inherently dynamic and expanding incorporation of organisms means letting go of the differentiated self we know. Here the limits of science merge naturally with religion. In wrestling with the fuzzy boundaries of self, we begin to speculate about our true nature and purpose. We wonder: If we choose to let go of self, what will we become? We find ourselves dangerously close to the precipice beyond which chaos reigns. Letting go requires faith that in relinquishing self, we become contributors to a creative process that ultimately transforms us for the better. In letting such faith guide our lives, we stop valuing our competitive isolation and start cultivating creative relationships. In these relationships we bring what is best in ourselves to the creative process, and we make ourselves open to what others bring. It is almost paradoxical that in moving

beyond the "completeness" of self, we encounter a sense of wholeness that the self alone cannot attain.

From the realization that neo-symbiosis supports an abiding faith in the power of creative relationships, we may come, if we choose, to the reemergence of God in history. For in placing our faith in mutual creativity as the source of transformation, we stumble upon God. Twentieth-century theologian Henry Nelson Wieman suggests how this might happen. Wieman examined the natural world for an experienced reality that is beyond our control, yet involves us in our own redemption. He found this reality in the Creative Event, which he identified as God. The Creative Event has four sub-events. First, the individual becomes aware of qualitative meaning extending from another organism. Second, this new meaning is integrated with the individual's old meaning. Third, the individual's capacity to appreciate the world is increased. And, finally, there is a widening and deepening of community among all participants.[14] The Creative Event itself always takes precedence over an individual's stated conception of truth. That is, one does not experience God in isolation, but in creative process with others. When human beings choose to come together in cooperative relationship, God moves among them as creativity, and yields transformation.

This does not mean that neo-symbiosis requires a theological position, nor does it automatically proclaim the reemergence of God in history. Wieman's approach to creativity is one of many we could incorporate into the neo-symbiotic narrative. Nevertheless, where competition leads us further into ourselves, neo-symbiotic cooperation leads us beyond ourselves into unknown space and time. This can be difficult and frightening. In claiming with Wieman that God is creativity, we give a name to that experience of selflessness at the center of the neo-symbiotic narrative. We enter the space between ourselves and other organisms, not knowing what may become of us, but believing that God/Creativity will transform us. This neo-symbiotic faith liberates us from the competitive stress of Social Darwinism, giving us the freedom to embrace cooperation and creativity as new organizing principles for our lives.

At the base of the neo-symbiotic narrative is science's revelation that Nature is cooperative. Symbiosis is the evidence our minds crave for the legitimate writing of a new narrative. It provides the much-needed metaphor to make our new history resonate deeply in our hearts. And its challenge to the self is the catalyst for a new faith in creativity that nourishes our souls. Neo-symbiosis thus encompasses a reconfiguration of science, history, and religion, such that we may encounter God acting anew in history.

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Endnotes:

[1]Darwin, pp. 116, 123.

[2]*Ibid.*, p. 117.

[3]*Ibid.*, p. 122.

[4]Spencer, pp. 9-80.

[5]*Ibid.*, pp. 414-415.

[6]Hofstadter, p. 45.

[7]*Ibid.*, p. 203.

[8]Margulis and Sagan, p. 64.

[9]Ibid., pp. 62-63.

[10]Nauts, p. 5.

[11]Shear, p. 390.

[12]Proper engineering virtually eliminates the pathogenicity of the salmonella. Treated mice in Pawelek's study lived twice as long as untreated mice. See Pawelek, Low, and Bermudes.

[13]Margulis and Sagan, p. 66.

[14]Southworth, pp. 41-42.

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Studying the Effects of Intercessory Prayer on Healing: A Theological Examination

Betsy Perabo

This essay is an exploration of some of the implications for theology and for religious practice that might be drawn from experiments to determine the effects upon the sick of intercessory prayer offered on their behalf by others.

Introduction

In 1982, a San Francisco cardiologist began a clinical trial to test the effectiveness of a certain treatment method on a group of about 393 hospital patients.[1] The study reported to demonstrate empirically that the treatment method was effective. Despite the fact that neither the patients nor their doctors were aware of whether they had received the treatment, thus eliminating the possibility of a placebo effect, patients who received it experienced an easier recovery than a control group of patients who did not. The study, similar to thousands of other medical experiments carried out every year using the same procedures, was different in one significant respect: the treatment method tested was prayer.

Although this is the only significant study on prayer that has been published in a major medical journal, it has raised the possibility that the effectiveness of prayer in healing could be empirically demonstrated. While the link between a patient's own religious beliefs and practices and his or her potential for recovery has been noted in clinical trials, there is a tacit assumption in the medical literature that this can be attributed to the patient's mental attitude rather than to intervention by God.[2] If dozens of scientifically acceptable trials on intercessory prayer produced results similar to those in the San Francisco study, both doctors and theologians would be forced to confront their assumptions about how healing occurs. If prayer is effective whether or not the patient is aware of it, and if this effectiveness can be proven through standard scientific methodology, doctors would be forced to alter radically the way they do business. Theologians and others would then need to consider a number of important questions related to the ways in which this scientific evidence does provide, or can provide, information about God. Obvious questions arise. Does God cure illness? and if so, under what circumstances? However, an empirical study of the effectiveness of prayer could be designed to answer other critical theological questions. An outline for such a study will be described below.

Divine activity and the body

In certain respects, the body is an ideal testing ground for determining the activity of God in the world. The body is the means by which we are intimately connected to the material world, intruding, with its need for food, sleep, or sex, upon what we might sometimes imagine as our more central and spiritual selves. However, although the healing of physical ailments is experienced in this intimate manner, in many cases it is also scientifically verifiable and quantifiable in a way other "religious experiences" are not. Additionally, other sorts of suffering may be alleviated due to human actions (for examples, a donation of money or a proposal of marriage), which complicates the issue of whether God has intervened directly in response to a prayer. The actions of others

do not directly affect illness in this way. Whether we view illness as a punishment from God, a challenge to spiritual growth, or an arbitrary affliction (issues beyond the scope of this essay), our understanding of God's role in treating illness has wider implications for our comprehension of God's activities in the world, in general, and of the very nature of God.

History of research

There is a long history of anecdotal evidence for the power of healing prayer, but the idea of studying its effects systematically has attracted little attention from either the medical community or religious healers. An 1872 article by F. Galton first broached the subject, stating that it is a valid topic of inquiry, but indicating that prayer probably is not an effective treatment .[3] Prior to the San Francisco study, only two small trials on the efficacy of prayer had appeared in the medical literature[4], and neither was considered conclusive.[5]

The San Francisco study, carried out by cardiologist Randolph Byrd, attempted to remedy the problems found in the earlier studies by expanding the group tested and bringing the trial's conditions into line with standard medical practices. In Byrd's study, patients admitted to San Francisco General Hospital's coronary care unit were randomly assigned to receive intercessory prayer, or not to receive it (control group). There were no statistical differences between the two groups at the time of admission. The intercessors, born–again Christians (as designated by Byrd) from local Protestant and Roman Catholic churches, were told to pray daily, outside of the hospital, for the selected patients. The hospital course after admittance--the degree to which the patient improved during the hospital stay--was classified as good, intermediate, or bad, based on an elaborate set of medical criteria. Of the patients in the prayer group, 85% had a good hospital course, 1% had an intermediate hospital course, and 14% had a bad hospital course. Compare to the control group: 73% good, 5% intermediate, and 22% bad. In his analysis of the study, Byrd concluded that these differences were statistically significant and demonstrated that intercessory prayer did indeed have verifiable therapeutic effects.

Since the medical community has opened itself, however tentatively, to a discussion of the verifiable effects of intercessory prayer, every attempt should be made to determine how this topic could be examined aggressively, not simply to determine the best treatment approaches, but to learn answers to critical theological questions.

Designing a study

If enough reputable studies are done that provide empirical evidence for the idea that prayer works in this way, further studies would be called for to pinpoint the effectiveness of particular types of prayer or particular intercessors. In the San Francisco study, only Christians prayed; the prayers of adherents of other traditions would also need to be tested. Atheists could be asked to wish someone well silently, in order to test the effectiveness of positive mental energy (an idea discussed further below). Prayers could be tested by people outside of their tradition: Buddhist intercessors could use Christian prayers, and atheist intercessors could invoke the gods of African indigenous religions. Studies could also be run on the characteristics of effective intercessors--age, gender, degree of religious commitment, etc.--and on the effect of similarities or dissimilarities between patient and intercessor, or possibly even the doctor. The nature of the patient's illness and the particulars of the recovery would also need to be examined.

The San Francisco study tested standard medical treatment in combination with prayer, against standard medical treatment alone. Additional comparative studies would also need to be run to include prayer as the sole treatment. Christian Scientists, for example, believe that people can heal themselves, or come to the realization that the illness is an illusion, with the aid of a practitioner.[6] (It should be noted that while Christian Scientists have put forward much

anecdotal evidence to support these claims, there have been many widely-publicized instances of failures, and scientifically valid studies on this subject are lacking.) These individuals believe that surgery and other standard medical treatments reflect a lack of faith in God and may have a detrimental effect. Thus, it is theoretically possible that prayer alone would be more effective than either of the other options. However, this would be more difficult to test, since the patients would be aware that traditional treatments were not being provided, unless deceptive (and probably ethically suspect) measures were taken to prevent them from discovering this. Nevertheless, perhaps experiments of this nature could be run--with the patient's consent--on less serious ailments: for example, a minor infection could be treated with prayer and a placebo, rather than penicillin. Should the effectiveness of prayer alone be demonstrated on these sorts of cases, it could become ethically permissible to test this method on more serious illnesses.

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Possible implications of the study

What would the results of such experiments say about the nature of God? Atheists or agnostics could say they mean nothing, unless a method could be developed to determine whether all prayers were working simply because of some sort of positive mental energy communicated by the intercessors (also, of course, impossible to track scientifically). On the other end of the spectrum, adherents of some traditions could argue that such successes reflect not God's work but Satan's; or that (if, for example, Buddhist intercessors were more effective than Christians) God is using these experiments to test the faithful, similar to the argument that fossils have been placed by God to see if Christians will be lured by science into a false belief in evolution. Consequently, anyone using the results of the study would first have to assume the existence of God, and to consider these healings by prayer to be a true reflection of God's activities.

Assuming these two things, then, theologians could learn from these experiments the following information about God: 1) whether God intervenes directly in the lives of individuals; 2) whether this intervention is consistent and therefore, perhaps, somehow "controllable" by human beings; 3) which religion and/or which group God favors, if any; 4) whether God is more concerned with practice or belief; and 5) whether God favors those who rely only on prayer, or heals as effectively or more effectively when medical science is used to complement it. All of these topics are enormously complex. The following discussion is intended only to give a sample of the sort of information that might be forthcoming as the result of a comprehensive prayer trial.

1. Divine intervention

A successful study of intercessory healing prayer could substantiate claims that God does intervene directly in the lives of individuals with respect to their physical health. This could have far–reaching implications for the discernment of divine intervention in other areas. Similar studies could be set up to test the impact of prayer on natural phenomena such as earthquake or drought, and on more complex situations involving free will--the rehabilitation of criminals, for example. This would clearly be an extremely fertile area for additional study.

2. Human circumscribing of God

Some would suggest that if God responds directly to prayers in a consistent and predictable fashion, the activities of God are somehow under human control: if certain conditions are met, God will auto-

matically respond in the desired manner. Even if God is the one doing the healing, people are the ones who somehow control it by opening up the channels through which it is carried out. However, a number of believers in healing prayer say this is not the case. According to Christian Science founder Mary Baker Eddy, humans are not healed because they ask God to do something and God does it; they merely are given the power to recognize the illusion of illness.[7] Others have argued that God could have willed the prayers as well as the healing.

3. Religious or personal favoritism.

A study of this nature could settle many of the questions relating to God's attitude towards and support of the various world religions. (In non–theistic belief systems, this relationship would be conceived of differently; for the sake of simplicity, "God" is used here.) If God answers the prayers of Jews but not of Christians, or vice versa, this would be an indication that one of these groups is on a more correct path. If, on the other hand, all prayers are answered with equal results, this could indicate that the differences between the world religions are insignificant--from God's perspective. The results could also indicate that God pays attention to the prayers of certain individuals regardless of religion; the reasons for which God might grant favor to these individuals would have to be explored.

4. Practice vs. belief

If, for example, an atheist patient is prayed for by an atheist intercessor using a Christian prayer, and recovers better than a Christian patient who is not prayed for at all, this could indicate that God is more concerned with the performance of religious rituals than an individual's beliefs. Given the stress of western Christianity on experiencing God personally, this could lead to a radical change in our views of the relative importance of these facets of religion. In some respects, God could then be viewed as the ancient Roman deities were, requiring acts of devotion rather than spiritual or intellectual commitment.

5. Degree of dependence

Another intriguing issue relates to the degree to which God intends people to rely directly on divine intervention in healing. There are three possibilities. A) If prayer alone is more effective than prayer in conjunction with standard medical treatment, God may be seen as rewarding those with a greater degree of dependence. Trust in God alone, to the exclusion of medical science, would then be given an extremely high value. However, a test of this sort would be skewed by the fact that the patient is unaware she is depending on God alone. B) If the two methods are similarly effective, God could be understood to be acting through both prayer and medical science. C) If prayer and medicine used together are more effective than either used separately, God may be encouraging people not to rely on prayer alone, but to look to their own abilities and talents in solving problems.

If religions are to use science as a confirmation of their beliefs, they must be willing to operate on science's own terms.

Reliance only on prayer could be viewed as testing God rather than trusting God.

Conclusion

For many people, even those who believe in the power of prayer, experiments such as these may seem to be ridiculous or even sacrilegious. To attempt to quantify God's activity in the world using mere human tools and methods, however "scientifically sophisticated," may be perceived as inane. The above list of information that could be yielded by healing prayer trials may read like a parody of both good science and good theology. Indeed, the medical journal articles on the subject, with titles such as "Positive Therapeutic Effects of

Intercessory Prayer in a Coronary Care Unit Population," have a surreal ring, and seem to conflate oddly the authority of medical science and the authority of God. For some, God is absolute mystery, radically unknowable; the San Francisco study is a fluke, and no comprehensive study such as the one suggested in this paper could ever yield intelligible or useful results, and those who believe otherwise are simply delusional. For others, carrying out experiments such as these demonstrates a lack of faith in God or sheer presumptuousness. They may believe in God's direct healing activities but also deem it inappropriate to test God in this way.

Nevertheless, many people have argued that the healing that God does in response to prayer is both real and reliable, and have put forth supporting reports. The Byrd study has been widely cited in the popular press and among the clergy, although usually without the precise statistics. (Byrd himself notes the relatively small differences in recovery evaluations between the prayer group and the control group, but says they may result from the fact that intercessors outside the study--such as family and friends--may have prayed for members of the control group.) If the effects of prayer are, in fact, real and reliable, they should be tested; and if the tests generate scientifically verifiable results, these should be used as a scientific basis for theological inquiry. If no scientifically verifiable information is yielded, believers, although they may still argue for the efficacy of prayer in healing, must acknowledge that it is not a consistent phenomenon. If religions are to use science as a confirmation of their beliefs, they must be willing to operate on science's own terms, exploring all of the things that science can teach them, and carefully considering the consequences of those results.

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Endnotes:

[1]See Byrd.

[2]See Marwick; Kowey, Friehling, and Marinchak..

[3]See Roland.

[4]See Joyce and Welldon; Collipp.

[5]See Rosner

[6]See Gottshalk.

[7]See Eddy.

The author wishes to thank Howard Rhodes for helpful comments on this essay.

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Deborah J. Pope-Lance

After showing the unsuitability of continuing to use some earlier models of divine action, the author examines the implications for God's involvement in the world suggested by the current understanding of the behavior of complex systems.

To the problem of God, Henry Nelson Wieman responds, "whatever the word God may mean, it is a term used to designate that Something upon which human life is most dependent for its security, welfare and increasing abundance. That there is Something cannot be doubted. The mere fact that human life happens, and continues to happen, proves this Something, however unknown, does certainly exist." [1]

Life happens. God is what makes life happen and continue to happen. How does life happen? All theology is cosmology--a theory about the origins, process and structure of the universe. Theologies and cosmologies outline how the universe happened, how it works and how it continues to happen.

Consider how the Medieval world worked, according to both theologians and scientists. The universe was a three-story apartment building. Heaven on the penthouse, full of stars and God. Earth on the middle floor, housing people and animals and plants. And in the basement, Hell, residence of the devil and the damned. From the penthouse, God watched humanity. God controlled and directed everything. Humanity prayed for God's mercy and salvation.

Lately, in the last 500 years or so, beginning about the time Copernicus discovered that the sun did not move around the earth, this view changed. Scientists no longer generally agreed with theologians about the nature of the universe. Theologians still look for God in heaven but scientists report God has moved. Scientists since Copernicus observe that the earth and the people on it are in motion. And that the earth is just one of many planets that move, and not the center of anything at all. No longer residing in heaven, watching and directing human life, God became a remote, uninvolved creator. Humanity, no longer the center of God's attention, managed the best it could.

Two interesting spiritual developments occurred as a result of this changed view. One was that humanity began to accept responsibility for the quality of life in the universe. Humanity could not manage God's scale of control, of course. But neither could we simply sit back and expect a free ride. Humanity had a partnership with God. A second spiritual development was acknowledgment of the human person as individual and unique, especially in perspective. Diversity was born. When God controlled everything, there were no individual opinions; just heresy. In the God-Human partnership, a variety of viewpoints are understood as valid and useful.

In contemporary formal scientific discourse, God rarely appears. But in private conversations, scientists sometimes acknowledge a reverence for the designer of this vast, complicatedly wondrous cosmos. More technical than theological, more watchmaker than loving parent, science's designer God amounts to necessary preconditions or operating structures. A designer God is theology as pure cosmology. God is how the universe is and how it works. One cosmology widely accepted by contemporary scientists is interdependence.

Based on biological models, interdependence states that all of life, humanity as well as all living organisms and systems, operates by an interdependence of various internal processes and within an interdependence of external processes. The universe is an interdependent web of existence.[2] The prosperity or survival of any life form is interdependent on all life forms. The universe is a big boat; we are all in the boat together.

This view is vastly different from the cosmology forwarded in the Book of Genesis. "Be fruitful and multiply," God directs humanity in the first chapter, "and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth." Hardly interdependent, humanity is described as living off the earth and every living thing like a parasite. Humanity's dominion has met with decidedly mixed results. Human existence now threatens earth's existence. In this cosmology, God, who made and directs everything, may need to make and direct a miracle in order to save creation.

Sometimes interdependence is suggested as a saving corrective to the mess made by humanity's dominion. Humanity should live interdependently with earth and every living thing, and disaster will be prevented. In this way, interdependence functions as a belief about how things could be, about how the world might be better, about how life might happen in a better way, if we were to think and act more interdependently. Before applying pesticides to kill off pesky insects, for example, humanity should consider how these pesticides will adversely impact human and other life. Thinking interdependently will lead to the discovery of insect-control methods that are less injurious to us and to the interdependent web of all existence.

Alice Walker speaks of this type of interdependent consciousness through her heroine in *The Color Purple*. Awed by the recognition that she was connected to everything else, Celie observes "that feeling of being part of everything, not separate at all. I knew that if I cut a tree, my arm would bleed."[3] And in the words attributed to Native American Chief Seattle, "Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect."[4] Walker's and Chief Seattle's views, while admittedly theological, describe a *quid-pro-quo* kind of connection. As corrective visions, they caution, "Don't hurt others because you'll hurt yourself." In an interdependent web of existence, however, connection is more complicated and pervasive. Interdependence cautions that whatever we do to any part of the web effects every part of the web.

Interdependence is the way everything is. Everything effects everything else. Even when you are not aware it does. Even when you cannot figure out how it interdepends, it does. We are all related. Everything is related to everything else. Nothing can be isolated or disintegrated from the whole.

Biological interdependence is not merely connection. It is interaction. All living systems and organisms operate according to feedback loops. Biological feedback loops operate like home thermostats. When we are cold and want it to be warmer, we turn the thermostat up to a higher temperature. The higher temperature turns the furnace on and generates heat. The temperature in the room gets hotter. The thermostat senses the hotter air exceeding the requested temperature and signals the furnace to stop generating heat.

In a simultaneous, interactive process of infinite interactions (and interactions of interactions), something can be both cause and effect.

All biological systems, big ecological systems, smaller organisms like humans, and even tinier organisms like sea coral,

reduce to feedback loops. These regulate everything. How many trout will be in the pond this summer? How much sunlight reaches the earth? Too much rain and lawn fertilizer, fewer trout; fewer trout, fewer tourists fishing, more mayflies; more mayflies, more trout. Unprecedented volcanic eruptions produce ash and smoke; the ash and smoke clouds the skies for months; less sun reaches the gardens; the temperature drops; the tomatoes are small. These feedback loops are described in more or less linear and consequential terms, but biological interdependence is more accurately circular and concurrent. And more complex.

Biological systems amount to endless interactive and simultaneous networks of feedback loops. Less sunlight reaching the earth reduces the algae in the pond, which in turn increases the oxygen in the water and the likelihood of more trout surviving. More trout may improve the fishing and raise the number of human neighbors. More humans in the area may result for a time in the increase of lawn fertilizer followed by a consciousness about the toxic effects of fertilizer on trout. In a simultaneous, interactive process of infinite interactions (and interactions of interactions) something can be both cause and effect.

A causes B. B causes C. C causes A. A is both cause and effect. Defying all customary logic, something can be both its own cause and effect. Brian Goodwin, an evolutionary biologist, observes, "The organism is the cause and effect of itself, its own intrinsic order and organization. Natural selection isn't the cause of organisms. Genes don't cause organisms. There are no causes of organisms. Organisms are self-causing agencies."[5]

In interdependence, God is not sitting in the penthouse, ordering out for green tomatoes and trout. Living systems and organisms are distributed systems. Control of what happens is not centralized or isolated but distributed throughout the system. Trout and tomatoes participate in the ordering-out process. The autonomous actions of every living thing connect and interact infinitely.

Among the more dramatic illustrations of distributed systems is the operation of a swarm of bees. Kevin Kelly describes it:

> A hive about to swarm is a hive possessed. It becomes visibly agitated around the mouth of its entrance. The colony whines in a centerless loud drone that vibrates the neighborhood. It begins to spit out masses of bees, as if it were emptying not only its guts but its soul.[6]

What commands a hive of bees to swarm? Scientists know it is not the queen bee.

> When a swarm pours itself out through the front slot of the hive, the queen bee can only follow. The queen's daughters manage the election of where and when the swarm should settle. A half dozen anonymous workers scout ahead to check possible hive locations in hollow trees or wall cavities. They report back to the resting swarm by dancing on its contracting surface. During the report, the more theatrically a scout dances, the better the site she is championing. Deputy bees check out competing sites according to the intensity of the dances and will concur by joining in the scout's twirling. That induces more followers to check out the lead prospects and join the ruckus when they return by leaping into the performance of their choice. Few bees visit more than one site.... [T]he bees simply get the message, "Go there, it's a nice place." So they go and return to say, "It's real nice, go there." The favorite sites get more visitors.... Gradually...the biggest crowd wins.... This is the true nature of democracy and of all distributed governance. By choice of the citizens, the swarm takes the queen and thunders off in the direction indicated by mob vote. The queen follows.[7]

The hive commands. A mob, thousands of bees united into one, directs itself to swarm.

An endless interactive network of feedback loops. The swarm has no center, but rather thousands of autonomous bees engaged in parallel actions, interacting with one another, influencing each other in nonlinear--even non-rational--ways. The bees decide to swarm out of the hive by interactive networking, by interplaying multiple directives, and by resolving a vast diversity of choice. The swarm is a distributed being, in which no individual part is more or less powerful, more or less valuable than any other. Whatever happens emerges from the interaction of all the bees.

Indeed, "the marvel of [a] hive mind," writes Kevin Kelly, "is that [while] no one is in control...an invisible hand [seemingly] governs, a hand that emerges not from any one bee but from [the individual bees all together]."[8] What emerges is more than a sum of its parts. In the words of an expert in ant colonies, a hive emerges from the mass of individual ants, a "superorganism superceding the resident properties of the collective ants." In this way "emergence was a way to reconcile the reduce-it-to-its-parts with the see-it-as-a-whole approach."[9] Emergence happens because of each part's capacity to connect, interact, to relate. Emergence keeps life happening, generating the whole's capacity to evolve, to create something new and distinct. Emergence is how life happens and continues to happen.

"If God is that Something," as Wieman attests, "that makes life happen," what can we learn of God from this biological model of interdependence? What sort of theology does this cosmology assume or infer?

In a distributed system, like a swarm of bees, what makes life happen, what controls everything, is the interaction of all the autonomous multiple parallel parts. God is not one supremely influential node in the network. God is not even the network itself. God is the capacity to network, to be immanent in an endless act of interacting and networking.

Martin Buber wrote in his most famous title, *I and Thou*, "In the beginning is the relation."[10] God is discerned not as a separated being, as an entity or figure, but a being in relation, as in the very essence of the verb, to be and to become. God is relation, the capacity to relate, connect, and interact, from which emerges life, evolving, new and abundant.

In an entirely secular perspective, this relational capacity has been identified as the process by which individual humans evolve. Psychologist Judith Jordan and other therapists have observed that psychological theories that posit a contained, distinct self, separated from its context, are limited and not wholly accurate. Instead, she offers a relational model of human development, which "stresses the importance of the intersubjective, relationally emergent nature of human experience." She observes that "the deepest sense of one's being is continuously formed in connection with others, and is inextricably tied to relational movement."[11]

Relationality. Connectivity. Interactivity. Emergence. These are the processes from which every living thing is created, survives, and prospers. The powers of God, immanent within and among all living forms and organisms. This is a relational god, wielding power in relation, a relation of which we are an essential participant. Carter Heyward observes that this power in relation, inherent in human life and in every living thing, is what we may lay claim to, in order to change the world. Heyward writes, "For god is nothing other than the eternally creative source of our relational power, our common strength, a god whose movement is to empower, bringing us into our own together, a god whose name in history is love."[12]

A god of relational power is quite other than a god in the three-story universe. The God who spoke to Job out of the whirlwind was omnipotent and almighty. "Who is this that darkens counsel with words without knowledge? Gird up your loins like a man, I will question you, and you shall declare to me. Where were you when I laid the foundations of the earth?"[13] Wielding unilateral power, Job's God is the biggest, most powerful being in his neighborhood called Universe.

Our previous understanding of our world is not working, because it is not fully or accurately informed by how things really work, especially complicated things.

Bernie Loomer, a process theologian, distinguishes these two kinds of power: "unilateral power" and "relational power." Unilateral power is "the capacity to produce an effect or to influence another." Unilateral power avails one with the capacity to control or manage another. Relational power is "the capacity to be influenced or to sustain a relationship" by or with another. Unilateral power assumes that one actor directs, manages, or coerces other actors to desired action. Relational power generates mutually determined action. Unilateral power has an inherent potential for abuse or violence, because by it one person is controlled and molded to another's whim. Relational power is inherently inclusive and mutual, because by it everyone is created and all action is determined. In relational power everything is a consequence of relationships with others. "The commitment, within relational power," as Loomer notes, is not to the self only and "not to each other but to the relationship which is creative of both."[14] Under unilateral power, diversity gives rise to the problem of heresy. Under relational power, diversity is not a problem to be solved, but a resource to be valued and utilized toward solution.

Wieman described God as "the growth of connection between activities which are appreciable."[15] In the same way that distributive beings have connective capacity, God, to Wieman's view, is connective capacity. Wieman considers God to be that which makes for possibility. Sounding remarkably like an evolutionary biologist, Wieman describes God as "Creativity," as "Creative Event," and as "Saving Creativity." "What will save and transform us," asks Wieman, "like nothing else can?" Our devotion to Creativity and Creative Interchange, he answers. He describes Creative Interchange this way:

> ...a process in relationship in which individuals express themselves truly and fully to one another; in which each welcomes and seeks to understand the undisguised individuality of the other; each understands the view held by the other and absorbs [that understanding] into a personal view. In this way, each expands and enriches the fullness of experience and increases the depth of reality which enters into personal consciousness.[16]

Wieman describes a process nearly identical to emergence in distributive systems. He asserts that what will save us like nothing else can is our expanded understanding of each other and our world and the exercise of our capacity to engage in the process that ever enlarges that understanding.

Wieman's soteriological perspective is similar to Kelly's and others'.[17] Our previous understanding of our world is not working, because it is not fully or accurately informed by how things really work, especially complicated things. If humanity is going to evolve and survive, we will have to manage increasingly complicated problems. Complicated problems and operations are simply too difficult to manage by centrally controlled processes. Distributive systems offer a capacity to evolve, the aggregate capacity of endless networks of parallel processes. Humanity will be saved only by using the way every living thing works, to make every living thing work better.

A god understood and experienced in these ways will have broader religious implications. Ethics will evolve from a conversation about rights and rules, obligations and principles, to a conversation about connections and creativity and how to enhance and empower both. Worship of an interactive and relational God may first challenge language's capacity to render passionately and poetically the spirit's movement among us. More importantly, worship will be understood to be about being in relation, about connecting in the interdependent web, and about participation. Indeed, "participation" will be "the holy thing giving shape to love and justice,"[18] a divine immanence whose image we not only share but exercise. God is not only that Something upon which human and all living things depend, but that Something in which every living thing will interdepend and participate.

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_____, and W. Horton. *The Growth of Religion*. Chicago: Willet, Clark & Co., 1938.

Endnotes:

[1]Wieman, *Religious Experience and Scientific Method*, p. 9.

[2]For a religious affirmation of the interdependent web of all existence, see the seventh principle of the Unitarian Universalist Association, found in *Singing the Living Tradition*, p. 1. For a scientific affirmation, see von Bertalanffy.

[3]Walker, p. 203.

[4]Seattle.

[5]See Kelly, p. 124.

[6]Kelly, p. 6.

[7]*Ibid*., p. 7.

[8]*Ibid*., p. 12.

[9]Wheeler, as quoted in Kelly, p. 11.

[10]Buber, p. 67.

[11]Jordan, p. 15.

[12]Heyward, p. 119.

[13]Job 38:2-4.

[14]Loomer, p. 87.

[15]Wieman and Horton, p. 353.

[16]Wieman, *Seeking a Faith for a New Age*, p. 102.

[17]Kelly, p. 4.

[18]Adams, p. 17.

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Theories of Grammar, Thoughts of God

Brian Mark Sietsema

This essay is an exploration of the potential of modern scientific linguistic study to provide insight into the ways of God.

The nature and power of language

There is an intimate connection between language and religion. The religious impulse of humankind expresses itself in manifold ways: sacred meals, visual arts, instrumental music, construction of holy spaces, offering of incense, ritual dance, ascetic postures and control of the breath, to name just a few. We tend, however, to identify the core expressions of faith with the operation of our linguistic faculty: prayer, hymnody, writing and reading of sacred texts, and the articulation of creeds. Indeed, our nonlinguistic expressions of faith often require the consecration of sacred words in order to qualify as holy. Islamic decorative art, for example, escapes from the prohibition against graven images simply because it developed from the exquisite stylization of the letters of the Qur'an.

The Christian tradition, in particular, exhibits an insistent orality in all of its forms of piety. Ritual acts, which might be performed wordlessly in other faiths, are always accompanied by language in Christianity. Incense is never offered without psalms and prayers; ancient and medieval Christian music made no use of instruments except as an accompaniment for the human voice. Unlike the silent Japanese tea ceremony, the Christian Eucharistic meal cannot be accomplished without the spoken words of consecration. Eastern Orthodox piety considers an icon to be uncanonical unless it bears a superscription with the name of the saint or feast depicted. Even the Christian form of "yoga," of meditative prayer and breath-control, is effected only in conjunction with the repetition of the Jesus prayer. The logocentric impulses of the Christian tradition are even more distilled in Reformational theology, which tends to favor verbal expressions of faith to the exclusion of all others, especially the visual arts.

This insistent orality of Christianity should probably come as no surprise, since we find that already in the earliest decades the Church's theologians were willing to elevate the very noun λογος, "word," to the status of a divine name. One might even argue that Christianity inherited this close connection between language and God as a legacy from Judaism, whose God revealed the inner life of the divine Self in the words of the Torah, and whose prophets were moved by God's Spirit to monumental poetic feats. The Biblical God also creates the world--not by laying a cosmic egg, nor by dividing up the corpse of the vanquished enemy--but by speaking: "By the word of the Lord the heavens were made, And all the host of them by the breath of God's mouth" (Psalm 33:6).

Being fashioned in the divine image, all human enterprises show a spark of this creative fire of God, but it is in the realm of language that humanity realizes its greatest similitude to the Creator. Humankind effects all other achievements in the arts and sciences through the refining, reworking, and reordering of existing materials: rocks, trees, oil, water, and plants become by our hands buildings, baseball bats, books, bread, and bassoons. But in no enterprise do we make something out of nothing, except in

our use of language. All humans who have the faculty of speech are capable in theory of uttering (or signing) an infinite number of sentences that have never been uttered before, of inventing new words, of telling new stories, of making a verbal thing that never existed before.

The philosopher J. L. Austin was the first to give a name to a particular feature of human linguistic creativity, the *performative* speech act. A performative speech act is an utterance that accomplishes something in the physical world merely by its vocalization. For example, a promise, an oath, and an apology are all created by the utterance of the following sentences:

> I promise that I will wash the car tomorrow.
>
> I swear that I never saw him before.
>
> I apologize for being so tardy.

Sometimes in order for a speech act to have performative force, certain contextual conditions must be met: the sentence,

> I christen thee the 'Santa Maria.'

actually names a boat, just in case the speaker is breaking a bottle of champagne across the bow of a sailing vessel. Contextual conditions for other performatives, such as,

> I now pronounce you man and wife.

or,

> I bet you five dollars and a beer.

are well defined by societal conventions. In any case, through the utterance of these speech acts a human being has actually created a thing--an abstract and intangible thing, to be sure, but a thing nonetheless, one that never existed before the moment of its utterance. Indeed, through a performative speech act one may create something that never existed before in the history of the world. For example, an almost certainly unique sentence, such as the following,

> I promise to name my next ferret "Betty," in honor of the B.T.I.

creates an obligation where there was none before--*ex nihilo*, one might even say.

Language, then, is not only intimately connected with our sundry exercises of religious feeling, but it is also integral to our composition as the *imago dei*, inasmuch as we reflect the image of the Creator in all our performative speech acts. In a singular way (according to the sensibilities of the peoples of the Book, at least), the Divine nature clothes Itself for us in language. The metaphor of language as Divine clothing suggests that the study of language may allow privileged insights into the Divine reality, that is, into the actions and energies of God. For example, if a chest of clothing from some unknown civilization were to wash up on the beach, we could garner many significant insights about the culture of that alien people simply from an examination of their garments: what their average height and weight are, the climate of their land, their level of technological achievement, and perhaps even what they eat (judging from stains on their apparel). Indeed, from the range of hues in which their garments were dyed we may even have a guess at their skin color, and from their choice to expose certain parts of the body and to cover others we may even have a glimpse into their notions of the erotic. Likewise, by examining human language as the clothing of God, we may derive some insights into the workings of the Divine nature.

Is in the realm of language that humanity realizes its greatest similitude to the Creator. In no enterprise do we make something out of nothing, except in our use of language.

Some elements of grammatical theory

Linguistics over the last century has come to a consensus that it is less appropriate to speak of human *grammars* than to speak of human *grammar*. The singular noun better conveys the linguistic notion that human beings have, by an innate

endowment, a common language faculty that operates within certain prescribed parameters. This single abstract grammar is worked out in different ways by different languages; but in a very real sense, all languages share a common set of principles according to which some constructions are grammatical and others are ungrammatical *in every language.*

One example of a deep grammatical principle can be found in English contraction "rules." Sentence (1) has two meanings:

(1) Which relatives do you want to visit?

In the first reading we understand the question to ask which relatives the interrogatee would like to entertain as guests, and in the second reading we understand the question to ask which relatives the interrogatee would like to go and see. These meanings correspond to the following underlying structures, respectively.

(2a) You want [which relatives to visit]?

(2b) You want [to visit which relatives]?

Sentence (1), however, can be pronounced with a contracted verb form, so that "want to" comes out as "wanna," as in (3). (The merits or demerits of such contractions are outside of the scope of this essay.)

(3) Which relative do you wanna visit?

Curiously, though, sentence (3) has only the meaning of (2b); it cannot have the meaning of (2a), in which the interrogatee would act as the host of visiting relatives. Perhaps this is because in such a case the contraction would have to take place across the syntactic gap left by the preposed noun phrase:

(4a) Which relatives do you want [____ to visit].

For the meaning conveyed by (2b), however, "want" and "to" are not separated in the underlying form by the movable noun phrase, and so the contraction rule finds no gap to jump over:

(4b) Which relatives do you want [to visit ____].

Speakers of English are quite unanimous in their judgments of the different potential meanings of sentences (1) and (3), though quite at a loss to explain why there is a difference or when they learned this fact about the contraction of "want to" to "wanna." In a roomful of Anglophones of different ages, from different parts of the country, and of different backgrounds, one might find no other point of universal agreement than this fact, that sentence (1) has two possible meanings and sentence (3) has only one. Linguists have learned, moreover, that gaps left by transposed words or phrases affect meanings in many languages.

An example of a universal grammatical proscription can be found in the following sentences:

(5a) Most drivers who own their own truck like to wash it once a week.

(5b) Most self-employed truckdrivers like to wash it once a week.

(5c) Most self-employed truckers like to wash it once a week.

In (5a), the pronoun "it" may have the preceding word "truck" as its antecedent (or it may refer to another noun in an earlier sentence not recorded here, such as "laundry"). In sentence (5b) and (5c), however, the pronoun *it* cannot be construed as having as its antecedent the word truck in the morphologically complex nouns "truckdrivers" or "truckers"; the pronoun must find its antecedent in some preceding sentence. (Or, if there is no salient noun in the preceding discourse, the word *it* in English may often be construed as referring to some taboo entity.) There seems to be a rule that says that a pronoun cannot look inside of a compound noun or a derived form in order to find its antecedent.

Again, these judgments of possible and impossible meanings are held unanimously by all native speakers of English and are matched by similar grammatical judgments of like constructions by native speakers of other languages. This is true, despite the fact that none of us had a lecture in seventh-grade English (or Dutch or Swahili) class on the impossibility of nouns within compounds to act as antecedents for a pronoun--or on the semantic possibilities of sentences with verbal contractions, for that matter. This bedrock of common knowledge about

our own languages is unconscious and untaught but very deeply *known* in the sense that we never break these rules through carelessness or ignorance, not even as children at an imperfect stage of learning our native languages. The parameters of possible meaning for contractions and pronouns seem somehow to be part of our basic linguistic endowment, part of the "universal grammar" of human speech.

In discovering that certain aspects of language are innate and, therefore, a matter of biological endowment, we discover that human language has certain *limits* of expression. Where there are parameters, there are necessarily boundaries. As we find the core principles of possible human grammars, we discover also that certain conceivable constructions are impossible for humans beings to learn as their native language. For example, there are languages with accentuation systems in which stress falls on the first or last syllable (Finnish and French, respectively, on the penultimate syllable (Polish), and on the antepenultimate syllable (Macedonian), but none with stress on the fourth-to-last syllable. It seems that human grammar just cannot count that high. Furthermore, in the Australian language Yidiny, the stress falls on all odd-numbered syllables (first, third, fifth) except when one of the even-numbered syllables has a long vowel, in which case stress falls on the even-numbered syllables. Such a stress system is very complicated: it would be far less complicated to have a stress rule that says, "Stress the last syllable if there is an odd number of syllables in a word, and the first syllable if there is an even number." No language, however, has a rule like this. Core human grammar, it seems, can count in some ways but not in others. Language is both infinite in its power to express new ideas and yet finite in its function, like all other human faculties.

Theological inferences

Some reflections arise from this brief study of grammatical theory. First, although linguistics has made the case that certain deep principles govern the grammar of all human languages, we must not lose sight of the fact that, in many ways, our languages vary considerably: we may use different sounds or different orderings of verb and direct object, or different classifications of grammatical gender for nouns, and so on. That is to say, despite our common linguistic endowment, we still have managed in our various cultures to devise wildly divergent systems of communications. We could all have the same syntax or phonology, but we do not. Such is not the case with animal communications systems: dogs have basically the same set of barks and cats the came set of meows and hisses, whether they live in Mexico or Malawi or Massachusetts. So while there is a certain core consistency to human language, there is also a certain innate possibility for great diversity. The task of discerning what is a core principle of language and what is a culture-specific feature of a given language is often difficult; the distinction between core and periphery in grammar emerges only through the study of many languages. This means that in order to discover our core human grammar, we cannot limit our investigations to our native language alone.

All who cherish a sacred text must admit that the God of eternity has accepted a sort of circumscription in choosing to be revealed in a limited set of words composed in a limited human grammar.

Second, linguists have noted that, despite the fact that humans have strong and consistent judgments about the grammaticality of certain constructions in their native language, they almost never have such clear intuitions about similar constructions in a language that is not their mother tongue. When we learn a second language after a certain age (generally considered to be around the onset of

puberty), our ability to have native intuitions is lost--even if our first language behaves very similarly to our second language in most respects. For example, Dutch is quite similar to its sister language English, but the two languages differ markedly in whether they allow a preposition to be "stranded," that is, left behind when its object has been moved to the front of the sentence. The two sentences in (6) have the same meaning, but the Dutch sentence is ungrammatical (as indicated by the asterisk), whereas the English sentence would be accepted by most native speakers.

(6a) *Welke vrouwen hebben jullie over gesproken? [Which women have you (*pl.*) about spoken?]

(6b) Which women have you spoken about?

Simply put, an English speaker must be taught this fact about Dutch, whereas seven-year-old Dutch children know this fact about their language even before their first lessons in grammar. This means that in our investigation of human language in all its variety, we cannot rely on ourselves alone: we require the collegial cooperation of linguists from every language background. Whereas in physics or chemistry or anatomy, a single scientist or a monocultural group of scientists have equal access to the raw data of their subject of inquiry, in linguistics we can advance only in a community of diverse scholars informing one another about the facts of our native languages. We can find our own innate human grammar, in other words, only by interacting with and learning from those who are linguistically different.

Let us return to the metaphor of language as Divine clothing. Consider again the hypothetical chest of clothes that washed ashore from an unknown civilization. Suppose we examined these garments and discovered that no article of clothing could be put on by one person alone, but that the arrangement of buttons or hooks or ties required that the one donning the apparel seek help from another person, who must stand facing the wearer of the garment. This fact would tell us a great deal about the sociology of our unknown culture: their notion of *community* would have to be refined to a very high degree. And yet this is precisely what we have found in our study of Divine clothing. The God who created language, and who through language reveals the ways of Divinity, and who in acts of religious language meets humanity, has forced humankind, in its investigations of language, to face one another, to form a community, to look for ourselves in the other, and to find our unity in our diversity.

The God who created language has forced humankind, in its investigations of language, to face one another, to form a community, to look for ourselves in the other, and to find our unity in our diversity.

In other words, we have in the linguistic enterprise an icon of the doctrine of the Trinity. Unity in diversity, diversity in unity, a mutual interpenetration of essence and a mutual self-discovery in community--this is classic Christian triadology. The Divine nature that clothes Itself in language is making a point for us about the makeup of the Divine life, and even more, invites us through linguistic study to participate vicariously in the Divine communal mode of existence.

Finally, the combination of infinite expressive power in a finite faculty reminds us that the infinite God, *through condescension*, is clothed in the finite workings of human speech. This observation holds, regardless of one's faith tradition: all who cherish a sacred text must admit that the God of eternity has accepted a sort of circumscription in choosing to be revealed in a limited set of words composed in a limited human grammar. In this sense, the inscripturation of Divine revelation stands as a type of the Christian belief in the Incarnation, the consummate Divine act of conde-

scension through the human enfleshment of the Son of God.

The intimate connection between faith and language, therefore, gives us hope that through the study of grammar we might learn more about this God of community and condescension Who meets us in our prayers.

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This essay was awarded a Second Prize.

On Learned Ignorance: Science and Unknowability in the Religious Enterprise

Jennifer Snow

The author looks at the importance of the dynamic of unknowability in theology and in science, alike. Both disciplines teach us about ourselves, not about God. Learning about the universe and our own place in it, we learn more about our fallibility and the need for humility.

Can science teach us anything new about God? No. Yet the work of science is extremely valuable to the religious endeavor--if we are willing to take what science teaches us seriously.

There have been theologians throughout the history of the Church, including Origen and Nicholas of Cusa, who have held that God is unknowable. And even those theologians who held otherwise, such as Augustine, were quite clear that the knowledge vouchsafed to us is very limited, and that it is only available by believing first and asking questions later. In the Christian tradition, the religious endeavor turns on belief without proof, on the subjective commitment to a Person whose existence and significance is doubted by many. The very dynamic of unknowability is deeply important; it is necessary to the religious enterprise that we constantly keep our ideas of God before us as ideas, and remain always ready to acknowledge our limitations before that which we try to comprehend. Trying to search out the nature of God through science is a futile endeavor; but remembering the inadequacy of our ideas of God is extremely important, and we can thank science in all its disciplines for making the search a necessity in today's world.

Science is helpful to religion, because it *increases* awareness of this religious dynamic of unknowability. Many people have argued that science undermines religious validity, because it undermines the "knowledge" that earlier generations have had of God. Science reminds us that this "knowledge" was false and misleading, and that "knowledge" is never the point anyway. Science teaches us ourselves, not God. It offers insights into the nature of religious *knowledge*, the nature of *religion*, and the importance of the *unknown*.

The traditional philosophical definition of knowledge is tripartite: to know is to hold a true, justified belief. To be true means that a given proposition represents reality accurately. To be justified means that there is external support for the proposition's truth. A true belief that is unjustified is merely a guess, while a false belief that is justified is simply wrong. Science seeks to match beliefs with reality by providing "objective" external justification. Religious beliefs, in order to qualify as knowledge, must also be able to check propositions against reality, must be able to find external justification for believing. In the past, Christians have sought to check their propositions against the external world, and particularly against the Scriptures. But science has dismantled the traditional arguments from natural theology--design, first and final cause, degrees of perfection, are no longer available to us to "prove" that our beliefs qualify as knowledge. And the authority of the Bible as an "objective" source of information has been greatly undermined by higher criticism.

Science, in the form of history, archaeology, and linguistics, has forced us to take stock again of the nature of revelation itself. Many liberal theologians no longer regard

the Bible as inerrant, but see it now as being the work of human beings--inspired by God, perhaps, but still human enough to speak a limited human language, written down and redacted by others who may not have been inspired at all. While some Christians have applied "scientific" methods to Scripture, using "Baconian" methods to discover what God intends, in doing so it seems that they prove only that it is impossible to read a coherent system of theology out of it without putting many of their own presuppositions into it. Not surprisingly, they find what they expected to find. The Bible exists as an "objective" artifact, but whatever knowledge it may offer is highly subjective. Scripture cannot serve as our objective justification.

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Scientific method begins by teaching that our conceptions do not always match reality--that they are forever subject to correction by a reality greater than they. We can learn from this that our ideas of God are not God, not the "reality" itself. Our conceptions are fluid, changeable. Where science attempts to compare conceptions to objective reality and correct conceptions thereby, we do not compare our theological conceptions to the reality of God, but to the reality of what the Scriptures say, or to what we have experienced, or to doctrinal standards. And these things in themselves are not God; they too are conceptions.

Science attempts "objectively" to measure reality and create conceptions that match this external truth, the "things as they are." Yet even scientists now realize that, at a certain point, purely objective measurement is impossible. The viewer cannot observe without participating in what is observed. Religious knowledge is similar (though, of course, the analogy is limited). There is no "objective" standard, no reality that is not conceptualized. In order to gain anything even resembling knowledge, we must enter into what we are observing--give credence to the Scriptures or to our own experience. But neither of these things of itself offers knowledge of absolute reality. Our own experience, which perhaps comes closest to what is free from conceptualization, is itself "subjective." It "proves" nothing. Through it, we may redefine our beliefs, our conceptions; but they remain fallible and subject to future revision.

The progress of science forces us constantly to remake our conceptions of God. For instance, the discoveries about evolution, the geological age of the earth, and the extent of the universe have forced us to recreate the idea of what a Creator could be, and what it could mean that we are created in God's image. Many of us realize now that our ideas of God are limited analogies and metaphors, rather than representative of sacred reality; and so we reinterpret the old ideas, repaint the pictures in our mind. Tillich's "ground of being," for instance, is a new picture of the creative activity of God. We are always in danger of becoming attached to our ideas; but science, if we listen to it, reminds us that idea is not reality.

Of course, a significant difference between religious conceptions and scientific conceptions is that science *does* envision someday getting to the bottom of it all. Some scientists believe that there is a finite amount of knowable things and that someday we will know them all. Their belief is that science's triumph will be the unveiling of all mysteries of the universe. The search in physics for a unified field theory, ever elusive, may someday be rewarded. Biology's fascination with the origins of life and paleontology's questions about evolution may someday be answered. Of course, not all scientists think this is possible; surely, there will always be technology, at

least, even if science comes to an end. Science pursues the *unknown.* Science as a whole tries to explain what we do not understand; individual scientists spend their lives learning what other scientists have done, and hope in their turn to contribute to knowledge, to discovery. It is the lure of discovering the unknown that makes science the great human story that it is. Should all mysteries one day be solved, on that day science will be dead.

Similarly, what would religion be if God were scientifically "known"--if propositions about the nature of God could be scientifically, objectively "proven"? Our relation with God is largely energized by the dynamic of not-knowing, of trusting without guarantees, of believing things that we cannot prove, of bowing our heads before inscrutability. The entire point of mystery and miracle is its inexplicability. When miracles are proved to be frauds or to have naturalistic explanations, they are no longer considered miracles. When mysteries are uncloaked, they are no longer mysteries. To some, theology is a devotion, not a science. As we learn about our universe, we learn about our ways of conceiving God, and find new ways of casting our definitional nets, individually and culturally; but because God remains unknown, the relationship with God is always new, always being rediscovered.

But don't we know anything about God? I would argue that our knowledge is limited to ourselves and our environments. The information that we have about God is really information about ourselves, and about the constructs of God we have created. For instance, we "know" that there is only one God, eternal and omnipotent, who should be the exclusive object of our worship. When we think about it, we know that God is to be worshipped simply because giving our hearts and souls to temporal things is a faulty and disappointing way to live. We know, and have always known, that turning ourselves towards the eternal is what is best for us. We identify God as eternal; indeed, eternality is part of the definition of God. Yet we do not know that God exists. We merely turn towards the inconceivable eternal as though it is a property of a person whom we love, knowing that to love anything else is, in the end, futile. We do not know God. We know only that we must not worship temporality. Our knowledge has reference to ourselves; it is our belief and our hope that have reference to God.

History, anthropology, and psychology teach us that religion is a deeply human pursuit, universal, taking on different forms in different times and places, and apparently with good and useful potentialities in every form. When the conceptions given by our religion are challenged by the conceptions of another, we can no longer easily assert that our form of religion is correct, that our form of religious knowledge is the only true one. Our "knowledge" of God is no longer absolute, but relative, fallible. We see ever more clearly that religion, like culture and language, exists for and is created by human beings. It is temporal, finite, historical, conditional. To worship a religion blindly, rather than God, is to offer sacrifice to a thing made with hands.

The transcendent God that Christians believe in could not, by definition, be discovered by objective study of the world. Science does help religion in the only way that it can: by teaching about its subject matter--ourselves, our universe, our experience. It can teach us about our ideas of God and of the sacred, and these ideas will change as our knowledge of ourselves changes. For instance, learning about other religions has, for many, precipitated a change in the view of exclusive salvation.

Our relation with God is largely energized by the dynamic of not-knowing, of trusting without guarantees, of believing things that we cannot prove, of bowing our heads before inscrutability.

We have also learned, from Freud, Marx, and cultural anthropologists and psychologists, to be wary of our religious ideas, to be aware that they tend to be about ourselves more than about God. From historians, we learn to place the Bible in historical context and to be wary of idolizing it. From physicists and biologists, we have learned to change our ideas of what it means to be "creator" of the world, and to afford greater respect to other living beings on the globe we share. We learn, too--or we should--that we are not the center of the universe after all, and that humility before the vastness of creation and the One who created suits us better than hubristic claims of our own importance.

This, it seems to me, is more true to the nature of the religious enterprise. The discovery of God does not involve knowledge, but belief, hope against hope. Trust, humility, love: these things do not involve "information." When we learn more about the universe, we learn about its greatness, and put ourselves in our place. We learn our own limits, compared to the limitlessness of the infinite. We learn to love and value what is outside ourselves, and give ourselves into God's hands for safekeeping. We learn that the world has room both for chance and determinedness. We learn that medicine can cure disease. We learn that we have it in our power to destroy ourselves and our home. We learn that death is inevitable, even for the universe. We learn that mortality--entropy--is the *sine qua non* of the entire creation. Both our will and our fate are given greater scope. And all these things we weave into our thoughts of God. Our science and the minutiae of our personal lives are brought to God in prayer and through theology--another sort of devotion.

Science does not show us God. It shows us that our pictures of God have been inadequate and intimates that they still are; and the nature of the subject matter reminds us that they always will be. What are we, that we should be able to comprehend God? Science is constantly teaching us to look at religious belief in new ways and with a critical eye, to remember that when we claim to have the sort of "objective" knowledge of God that science has of the universe, we are mistaken, deluded by pride. Our belief must be valued as the bridge that we build between ourselves and God, trusting in what we do not understand. Science, in its methods and its discoveries, constantly gives the religious person cause to let go of false claims to infallible knowledge. Though science does not show us God, it reminds us that we have always been in danger of creating God for ourselves.

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This essay was awarded an Honorable Mention.

Science and the Knowledge of God: From Machine to Metaphor

Peter S. Sprigg

After a review of how the machine model of nature has been used to argue both for and against the existence of God, the author makes the case that metaphors borrowed from the sciences can suggest new information about God.

The idea that we can or should "learn more about God" from "sources of information beyond the Scriptures" may raise a red flag of caution for many evangelical Christians. Evangelicals and their predecessors have spent the last century or more urging people to seek learning and information about God from within the Scriptures, and discouraging them from looking elsewhere.

However, the idea that we can obtain meaningful information about God from extra-biblical sources is not without precedent in evangelical theology, and in Scripture itself. If we view God's creation as a form of revelation from God, and we view nature as being God's creation, and we view science as the study of nature, then we can even suggest that science may serve as one means of discerning God's own self-revelation.

A number of terms have been applied to this way of gaining knowledge about God. "Natural theology," "general revelation," and "common grace" are all related concepts but can take on slightly different nuances, depending on the historical, ideological and theological commitments of the persons using the terms. "Natural theology" has been official dogma for the Roman Catholic Church since Vatican Council I.[1] However, it is frequently criticized by Protestants, who accuse the "natural theologians" of underestimating the corruption of human reason caused by sin, and also accuse them (perhaps unfairly) of suggesting that God's self-revelation in nature is sufficient for an observer to attain salvation, even apart from the "special revelation" through Christ and the Bible.

Protestants, therefore, have tended to prefer the term "general revelation" over "natural theology." It carries with it the conviction that God has revealed the divine self in two principal ways--through creation ("general revelation") and through Christ and the Scriptures ("special revelation"). And most Protestants would agree that the former provides insufficient information to attain salvation without the addition of the latter.

Protestants remain divided, however, on whether God's "general revelation" in nature is even intelligible to human beings who lack a prior faith in Christ. Is it, in other words, part of God's "common grace," freely available to all? Or, is even the "general revelation" only comprehensible by virtue of God's "special grace" through Jesus Christ? Karl Barth is among those who argued the latter (breaking sharply with Emil Brunner over the issue).[2] Reformed theologian G. C. Berkouwer likewise argues that "no true knowledge of the revelation of God in the works of his hands is obtainable without faith in Christ,"[3] adding that "when God's Word is not heard, his working is no longer understood."[4]

However, Scripture itself would seem to indicate that nature does indeed testify to God in a way that all can understand. Psalm 19:1-4, for instance, declares:

> The heavens are telling the glory of God;
> and the firmament proclaims God's handiwork.
> Day to day pours forth speech,
> and night to night declares knowledge.
> There is no speech, nor are there words;
> their voice is not heard;
> yet their voice goes out through all the earth,
> and their words to the end of the world.

The apostle Paul made a similar point in his letter to the Romans. In Romans 1:19-20, he is not speaking about believers, but warning of God's wrath against the wicked:

> For what can be known about God is plain to them, because God has shown it to them. Ever since the creation of the world God's eternal power and divine nature, invisible though they are, have been understood and seen through the things God has made. So they are without excuse...

These passages seem to show plainly that God's "general revelation" is indeed part of "common grace." John Calvin said, "There are innumerable evidences both in heaven and on earth that declare his wonderful wisdom," including those "for the general observation of which astronomy, medicine, and all natural science are intended."[5] It therefore seems reasonable to conclude that an evangelical can accept the findings of the natural sciences as one source of knowledge about God.

In examining the relationship between science and religious belief, it is intriguing how often one particular concept comes up. This is the concept of a "machine." What makes it intriguing is that the image of a machine is employed by those at completely opposite ends of the spectrum--by both believers and unbelievers. Those who believe in science and are skeptical about God argue that both the universe and living things can be described as functioning as machines--and, therefore, there is no need, nor room, for the supernatural intervention or sustenance of God. Those, on the other hand, who believe in God (and may harbor some skepticism about science) argue that the machine-like precision that describes the functioning of both life and the cosmos is exactly the thing that proves the existence of God. These two views of the machine will be examined before a third approach to the relationship of science and religion is proposed.

Virginia Stem Owens writes that "ever since the age of Newton and the classical laws of physics, civilized folk have agreed that matter is essentially a manipulable machine."[6] The new view of the heavens promoted by Galileo and Copernicus should also be credited with helping to foster the view that knowable forces lead to predictable events in nature. And the notable successes experienced in applying machines to science (the telescope, the microscope) and in applying science to machines (the industrial revolution) also seemed to shrink the realms in which knowledge or achievement were dependent upon divine revelation, supernatural mystery, or miraculous intervention.

Nevertheless, as recently as 1851 an observer could write that "science...is in almost every great department thoroughly Christian in its radical principles, and in the sincerest and deepest convictions of those by whose labors it has been formed."[7] Yet only a half century later, an author would take two volumes to describe *A History of the Warfare of Science with Theology in Christendom*.[8] And by the mid-twentieth century a theologian would declare that "in our modern universities...more than ninety percent of the faculty are either completely naturalistic or materialistic..., or very nominally religious."[9] What could have so tipped the balance against the spirit and in favor of the machine?

The obvious answer is Darwin's theory of evolution. If naturalistic, mechanical processes could explain not only the movement of falling bodies and heavenly ones, but the origins of different life-forms, then what place was there left for God? Critics of Christianity such as Bertrand Russell could take glee in declaring that "everything distinctive of living matter can be reduced to chemistry, and therefore ultimately to physics."[10] And books by contemporary Darwinist Richard Dawkins are sold with the assertion, "Man is a gene machine, blindly programmed to preserve its

selfish genes."[11] Dawkins even bluntly credits Darwin with making it possible to be an "intellectually fulfilled atheist."[12]

However, the picture of nature as a machine does not belong to atheists alone. It has been used for quite the opposite purpose. The classic example is nineteenth-century Christian apologist William Paley. In his book *Natural Theology*, he gives an oft-quoted illustration:

> In crossing a heath, ...suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place.... When we come to inspect the watch, we perceive...that its several parts are framed and put together for a purpose, *e.g.* that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; that if the different parts had been differently shaped..., of a different size or placed after any other manner, or in any other order either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it.... The inference, we think, is inevitable; that the watch must have had a maker...who formed it for the purpose which we find it actually to answer....
>
> Every manifestation of design, which existed in the watch, exists in the works of nature...[which] are not less evidently mechanical, not less evidently contrivances, not less evidently accommodated to their end, ...than are the most perfect productions of human ingenuity.[13]

Paley's "argument from design" for the existence of God came under attack over time from philosophers and scientists alike. The theory of evolution seemed to provide a plausible explanation for the appearance of design based only on the blind forces of natural selection (hence, Dawkins' book title, *The Blind Watchmaker*).

But a funny thing happened on the way to a completely naturalistic and mechanistic view of reality. The twentieth century, which was supposed to uncover the remaining pieces of the machine while closing the few remaining windows open to supernatural intervention, did just about the opposite. In realms of science from the very large (the origin of the universe) to the very small (molecular biology), the naturalistic answers are missing, while the evidence for what is now called "intelligent design" is growing.

Let us look first at that which is older and larger--the universe itself. Of all the findings of the cosmologists in this century, one of the most easily understood (and thus easily nicknamed) is the "Big Bang" theory. The discovery that nearly all observable galaxies in every direction of the sky are moving away from our own galaxy at considerable rates of speed led to the idea that the entire universe is expanding. Extrapolating this motion backwards in time led to the conclusion that the universe, instead of having existed in a "steady state" for all eternity, had in fact burst into existence in a huge explosion at a particular point in time and an unbelievably small point in space. This view of an instantaneous creation of all that is, at a moment before the physical laws of our universe even operated, sounds suspiciously like the description given in the first few verses of Genesis.

Another aspect of the new cosmology that suggests the existence of design is what has come to be known as the Anthropic Principle. This is the observation that many of the characteristics of the universe seem to be precisely calibrated so as to produce the only conceivable type of universe in which human life could exist. Of course, some would say this is a rather circular argument, because if the universe had been otherwise, no one would have been here to ponder its characteristics. And for all we know, there may be, or have been, billions of parallel universes without these characteristics.

However, the inference of intentional design remains an obvious and tempting one. Hugh Ross, an astrophysicist (and evangelical Christian), cites no less than 26 such precise characteristics, some of which "must be fine-tuned to better than one part in 10^{37} for life of any kind to exist." These range from the "strong nuclear force constant" to the "velocity of light" to the "decay rate of the proton" to the "polarity of the water molecule." And just for good measure, Ross adds another 33 characteristics of our "Galaxy-Sun-Earth-Moon System" that are essential to the development of life.[14]

Even when we turn to Darwin's own science of biology, we see that the evidence of intelligent design keeps popping up. The discovery of the double-helix design of the DNA molecule, for example, appeared to reveal that an incredibly intricate and purposeful design is at the foundation of life.

More recently, biochemist Michael Behe has challenged naturalistic views of evolution by carefully describing biological structures of "irreducible complexity." To suggest that all life evolved from a single cell, for instance, has little utility in explaining how life began when we observe that even a single cell is incredibly complex. Behe returns to our central image, saying that "life is based on machines--machines made of molecules! ...Highly sophisticated molecular machines control every cellular process. Thus the details of life are finely calibrated, and the machinery of life enormously complex." [15]

As an example, Behe provides an illustration of "the biochemical complexity of a bacterial flagellum," which is complete with a drive shaft, rotor, bushing, universal joint, and propeller! Our knowledge of how such processes work has become quite comprehensive, but Behe notes that if you search the scientific literature for theories as to how such machines developed in the first place, "you find an eerie and complete silence." In the end, he suggests, "we are left with no substantive defense against what feels to be a strange conclusion: that life was designed by an intelligent agent." [16]

Robert Jastrow has put the present state of science in perspective:

> For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries.[17]

So in science, the machine that has no room for God has faltered, and the machine that makes God a necessity is now ascendant. The theologians have won. But what, exactly, have they won? Have we really experienced "an increase in information about God, the Sacred, or the Spiritual?"

After all, theologians, particularly evangelical Christian ones, assert much more about God than merely the fact of existence. They also do not merely assert that God is intelligent, deliberate, and powerful. Does science have anything to say for or against such Christian doctrines as the trinity, the incarnation, or the atonement? What about prayer, predestination, and judgment? Can it solve the problem of evil, once and for all?

Hugh Ross, the prolific evangelical author and scientist-apologist, has ambitiously suggested that science can indeed answer such questions. In his recent book, *Beyond the Cosmos*, he draws on the concept of "extra-dimensionality" to suggest answers to a number of theological puzzles. We are accustomed to living in a four-dimensional universe (the three dimensions of space, plus time). We have also grown accustomed to thinking of the fundamental subatomic particles as points. However, recent research has shown that it may be more useful to conceive of them as vibrating "strings." This "string theory" has brought us closer to the goal of a unifying the four fundamental forces of nature under a single theory. It also provides a plausible description of conditions much closer to the initial moment of the Big Bang. There is only one problem: It requires not three or four dimensions, but ten in which to operate.

So in science, the machine that has no room for God has faltered, and the machine that makes God a necessity is now ascendant. The theologians have won. But what, exactly, have they won?

As a result of this view of the first split-second of creation, Ross concludes that the Creator must actually operate in at least eleven dimensions. This "extra-dimensionality" may help to explain some doctrines that appear otherwise paradoxical to those of us limited to four dimensions. For example, how could Jesus be both God and a human being? After the crucifixion, how could he be both dead and alive?

An illustration of the answer may be drawn from the dimensions we do understand. For example, a circle, by definition, cannnot at the same time be a triangle--that is, if we are dealing in only two dimensions. In three dimensions, however, it is possible to have the shape of a cone, which is both a triangle (when viewed from the side) and a circle (when viewed from the top) at the same time. In the same way, God's existence in dimensions beyond our own constitutes a scientific explanation of the divine ability to do things and have qualities that are impossible for us.[18]

But does this really "prove" anything about God? Does string theory demonstrate that Jesus was God incarnate? It would be a huge leap to make such a definitive claim. So what kind of contribution, if any, do such scientific findings make for our understanding of God?

The answer, I believe, requires us to move beyond the concept of machine to that of metaphor. Science cannot show us directly what God's essence is, because God is beyond our capacity to understand. What it can do, however, is to provide us with new ways of thinking about what God might be like--in other words, with new metaphors for our theology.

Once again, however, my fellow evangelicals may bristle--this time at the thought of reducing our conceptions of God to the level of "mere metaphor." My argument, however, is that the concept of "metaphor" does not deserve the diminutive "mere." As evidence, we need only return to the special revelation of Scripture itself. We have tended to forget that some of the most common terms for God in the Bible are in fact metaphors. Every time we call God "father," for instance, we are using a metaphor, knowing full well that it was not God's sperm that united with our mother's egg to form us. The absence of wool on our bodies hardly causes us to question Jesus' characterization of himself as our "shepherd." And we do not need to have lived under slavery or feudalism to understand submission to our "Lord."

My fellow evangelicals may bristle at the thought of reducing our conceptions of God to the level of "mere metaphor." My argument, however, is that the concept of "metaphor" does not deserve the diminutive "mere."

There are dangers in resting theology upon science. One is finding God only in the gaps where science offers no explanations. The danger is that as the gaps grow smaller, our concept of God does, too.

Another is in tying our ideas about God too much to one scientific paradigm--be it that of Aristotle, Ptolemy, or Copernicus, Darwin, Einstein, or Hawking. When the paradigm shifts, there may be no platform for our God.

But there are two things that science can do, and recently has done, for our theology. It can, perhaps surprisingly, break down barriers to belief in God's existence; and it can provide new metaphors to help us finite creatures conceptualize the infinite God. In doing the latter, in helping us to move beyond nature-as-machine to nature-as-metaphor, science has indeed helped us to learn more about God.

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Endnotes:

[1]See Van Engen.

[2]See Fraenkel.

[3]Berkouwer, p. 285.

[4]*Ibid.*, p. 331.

[5]Calvin, I.v.2, p. 53.

[6]Owens, p. viii.

[7]Baird, p. 125.

[8]See White.

[9]Ramm, p. 17.

[10]Russell, as quoted in Ramm, p. 55.

[11]Dawkins, *The Selfish Gene*, book jacket.

[12]Dawkins, *The Blind Watchmaker*, p. 6.

[13]Paley, pp. 5-6, 13.

[14]Ross, pp. 118-21, 138-41 (reveiw edn).

[15]Behe, pp. 4-5.

[16]*Ibid.*, pp. ii, 5, 252.

[17]Jastrow, p. 116.

[18]Ross, pp. 55-56.

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Creation and Revelation: Two Edges of Contact Between Science and Religion

Bob Wickizer

The author, who is a physicist, engages in theological conjecture suggested by some of the concepts of his discipline, demonstrating the fruitfulness of creative appropriation of ideas across disciplinary boundaries. Two futuristic scenes contrast possible developments of the Church within a technological society.

Junika stepped into her pew at the New Crystal Chapel in the City of the Angels, and immediately her personal reality space there alongside other worshippers changed chameleon-like to the rhythm of her own thought patterns. Images of ancient and modern scenes flashed before her retinas in pace with the powerful voice breaking open the timeworn words of a ritual performed long ago by priests in black robes. Pleasurable sensations arose within her as the bio-computed virtual Eucharist reached its peak with the words invoking the Holy Spirit to come upon these gifts. They were followed by a quick sense of satiation. Stepping out of her space, Junika glanced at her watch, as if her appointed worship time today would be any different from last week's. "There it's done, fifteen minutes and I feel closer to God." Out on the street humanity surged like New York on a sultry day. Those who could afford the city and what modern life had to offer walked with the confidence of a Centurion, while far off in the sun-parched valleys lived the masses who were about to inherit the earth.

The irony of this futuristic vignette is that the evangelicals, with their wealth and their zeal for a personal encounter with our savior Jesus Christ, evolved their churches into a technological, individualistic ritual society that idolized the encounter itself, stripping it of any meaning, reality, faith-community or purpose. They fashioned their hi-tech Jesus by introducing one technological innovation after another, until the upbeat evangelical churches turned into "cyber-cafés" of virtual encounters with the divine, and into real profits with the bank. Even the growing mega-churches in Asia converted to this techno-religion, owing to its increased efficiencies and its use of local technology. During this same period, the Roman Catholic and mainline Protestant churches managed to fill only a few splendid cathedrals with tradition-bound conservatives, while the radical sects of Roman Catholics, Anglicans, and Protestants lived among the burgeoning masses of the poor, whose existence hovered tenuously between the potential for another disastrous cereal-crop failure, and the ability of the bio-pharm labs to manipulate the crop genetics one step ahead of the Divine plan. The question is, will technology ever keep us one step ahead of God, or is everything we call progress just a gossamer-thin illusion for our radical separation from that which is both really true and truly real? Can science and religious faith coexist in a "both-and" proposition, or do we sail on a collision course where the objects of worship become technological, media-generated radical isolation, while wisdom and faith become known only to those whose lives derive directly from laboring on the land?

Introduction

This essay will cover an enormous range of scientific ideas in an attempt to establish a working dialogue between two fields that are rapidly diverging, at a time when the world desperately needs a convergence and integration of thought and ethics. In the course of these Annie-Dillard-like musings, two edges of contact between theology and science will be explored. One

is revelational, and the other involves creation or the "Creative Power," as Dorothy Sayers puts it. The science fiction opening and closing paragraphs frame two distinctly plausible futures. The first presents a culture that continued on today's course, to become alienated and fragmented by technology. The closing story shows another plausible future, where social relationships reach a more egalitarian level, and humanity's relationship to knowledge has shifted away from today's narcissistic, self-interested sphere, toward a more humble, respectful position in relation to Divine mystery. The aim of this paper, then, is to demonstrate the plausible existence of two common boundaries shared by science and theology, in hopes of kindling further dialogue along new lines. A longer-term goal of this general effort involves the mission of the church itself, in getting both sides to incorporate Divine mystery into their schemas, and to lead the culture in its understanding of the place of the Creative Power, not only in religious processes, but in the scientific method itself. The harvest is plentiful--*and* the laborers are plentiful. Where are we to begin?

How can scientific theories apply to theology?

Casting about for an overlap between science and theology, we haul up from the bottom of physics the detritus of ideas examined by philosophers and theologians from Newton to Chopra. Many of these ideas have been considered by modern philosophers and theologians with the intent of working physical theories into a systematic framework for the unscientific fields of theology or philosophy. We will stop far short of a systematic approach, hoping only that a review of some of major advances in the sciences may help point our hearts and minds in the right direction. We should note carefully, however, that physical theories are not used to explain theology, interpret scripture, or to explain human nature. Rather, what can be gleaned from the major scientific advances are ways of looking at the cosmos; and from that point, some theological conjecture or, at best, extrapolations can be offered.

The first stop is the idea of invariance. As Einstein first conceived of special relativity, spinning his well-known railroad car explanations, he must have been troubled by the idea that fundamental physical properties such as distance, time, and mass vary or change quantitatively depending upon the observer's frame of reference. Simply put, a yardstick will not be measured as thirty-six inches in length by an observer traveling at a velocity close to the speed of light relative to the location of the yardstick. It turns out that in the model of the universe explained by special relativity, only a handful of all the hundreds of basic physical properties of the universe are found to be invariant in this sense. In a more poetic sense, however, ideas such as "*terra firma*"[1] and the so called "truth claims about God" need to be critically examined in the humbling shadow of one fact--namely, that there are very few things in the universe that are absolutely true and unvarying in all times and in all places. Perhaps Pilate was onto something when he asked Jesus, "What is truth?"

We should avoid the common trap of extending the idea of relativistic invariance in the world of physics to a relativizing of ethics. Instead, invariance can be used as one of many chains that bind and constrain epistemology or what we can know about the universe.

Two other links in the chain that we can borrow from the physics of the early twentieth century are the famous Heisenberg Uncertainty Principle and the Gödel Incompleteness Theorem.[3] As Einstein wrestled with the failure of classical (Newtonian) physics to explain the phenomena of relativistic variations when observer and observed frames of reference move relative to one another at nearly the speed of light, Werner Heisenberg and others wrestled with the failures of classical physics to explain phenomena of very small, atomic-scale interactions. In brief, on a softball field, we can set up an experiment to measure simultaneously the position and

momentum (mass times velocity) of a softball to any degree of precision desired. The accuracy of making such a measurement is limited only by the experimental equipment we use. If we try to make the same measurements on an electron traveling around a hydrogen nucleus, we find that there is a quantitative barrier beyond which we cannot more accurately and simultaneously measure the position and momentum of the electron. No matter how accurate our experimental apparatus becomes, there is a fundamental, physical limit to the state of our knowledge even about one of the simplest physical systems of all, the hydrogen atom.

In a sense, these pi and sigma bonds are really "clouds of unknowing," where scientists are comfortable within the limitations to their knowledge. After all, the theories are good enough to develop new plastics and pharmaceuticals.

Contemporaneously with Einstein's and Heisenberg's work, the mathematician, Kurt Gödel posed his Incompleteness Theorem, stating that any axiomatic mathematical system (such as Euclidean geometry) will always contain questions that cannot be proved or disproved on the basis of the axioms within the system. Even though some have noted that only mathematicians and God can play with truth, Gödel's proof forces mathematics to take its place alongside theology and other disciplines as "unfinished objects," or fields where knowledge and truth may be necessary, but can never be sufficient. There will always be more.

Given these conjectures regarding the limits of knowledge, then towards what end is knowledge being pursued? When we study organic chemistry, we learn about the chemical bonds of outer electrons described as "pi" and "sigma" bonds, which are constructed mathematically as "probability clouds" describing where the electron is likely to be. In a sense, these pi and sigma bonds are really "clouds of unknowing," where scientists are comfortable within the limitations to their knowledge. After all, the theories are good enough to develop new plastics and pharmaceuticals. Why worry about truth and completeness?

At the same time, rational, systematic handling of theology tries to construct complete, theologically dogmatic descriptions of the divine, often without incorporating mystery. We may have stumbled upon an irony here, where the scientist lives with mystery and unknowing every day, and even incorporates theoretical formulations that deliver useful benefits to humanity. The theologian, on the other hand, presses on, hoping to construct a sufficient, dogmatic system, sometimes avoiding mystery as much as possible.

Departing from the arena of epistemology, we find more parallels between the use of system approaches in thermodynamics and biology and religious communities. Without reviewing the histories of science in two diverse fields, one of the important ideas that emerged from the late nineteenth century onwards was that populations can be modeled in useful ways. Groups of things can be measured, and theories can be developed to explain phenomena ranging from the pressure of a gas in a balloon to the fluctuations of snowshoe hare populations in the Arctic. In Christian ethics we find that "there is neither Greek nor Jew, slave nor free..." We are commanded to love our neighbor as ourselves. We are equal as individuals in the eyes of a loving God, but populations and communities matter, too. We may all be equal spirits, zipping around with Brownian motion in the Divine plan; but just as the aggregate behavior of gas molecules causes a phenomenon we call "pressure," it is the community of faith that creates meaning. The Christian ethic is full

of paradoxes. We are equal in the eyes of God, but the shepherd will go to any length to save the one lost sheep. Individuals are saved by grace now, but at the end of time, all will be judged.

Two edges of contact between science and theology

Revelation

In a poetry reading in Cambridge last year, Robert Bly observed that many new science Ph.D. graduates today have a passion to "knock off" the leading theorists in their respective fields. The sense that a scientist stands on the shoulders of her or his predecessors seems to have been replaced by a prevailing attitude of narcissism, fueled by fear. Given the pressures of modern society and academia, the presence of fear that leads to narcissism may not be unique to the scientific disciplines. The fear involved in this process may involve a gnawing suspicion that there is more, that the theory is not complete or sufficient. The fear may involve personal issues such as perfectionism, elitism, or egoism. The bottom line of a quest for knowledge and insight, whether in physics or theology, is that in the presence of personal fear, the end towards which knowledge is pursued becomes pure narcissism, a building up of the self without regard for others--or worse, a building up of the self at the expense of others. If we seek knowledge and insight courageously, what is the starting point of the quest? and where does it lead?

Just as the aggregate behavior of gas molecules causes a phenomenon we call "pressure," it is the community of faith that creates meaning.

The scientist starts with a belief in the ability of the rational, human mind to reach new insights and gain new knowledge. From that basis, the scientist proceeds with an understanding that there must exist a formal way to explain the observed phenomena. In spite of these two layers of rationality, and the impressive achievements of the past century, the courageous scientist will ultimately acknowledge that Gödel was correct: that there is always more than the theory can explain. The courageous scientist will become inexorably drawn from a position of certitude and confidence to another place of uncertainty and mystery. The courageous scientist will move from what is rational to what is not rational. The end towards which this scientist pursues knowledge then becomes part of the mystery, as well. The revelation of that which is more, or Tillich's "ultimate being," emerges from the scientist's peering into a universe that is full of unknowables. Thus, science and theology converge on one edge of revelation of the real source and font of all knowledge. It all begins with reviewing what we do not know and cannot ever know. Can we see God face to face and live?

Creation

The scientific method is nonlinear; it loops endlessly, repeating a cycle of hypothesis, experiment, data collection, test of hypothesis, and the emergence of more questions that lead to yet another hypothesis. In this looping, the scientific method works largely in a sphere of rationality. When great discoveries are made, and bold leaps taken by leading scientists who permanently change the paradigm for a field of knowledge, those leaps move into mystery and a "non-rational" sphere. The imaginings of Einstein, Heisenberg, and Gödel would have seemed wildly speculative or even preposterous to some in their day.

The "religious method" or liturgy[2] is also nonlinear, looping endlessly in a cycle where people gather together, praise and give thanks to God, enter the mystery (of a sacrament); and at the end of the liturgy the people go out into the world to return again at a later time, often with more questions. Unlike the scientific method, the religious method loops largely within a non-rational

sphere. Mystery is already present, but what is lacking is empirical data. When saints, sinners, and everyday people begin to grasp the implications of the liturgy in their daily lives, they become motivated by their ethical considerations to perform works of justice. These works of justice are the empirical data of the religious method, and in a fashion that is complementary to the scientific method, the religious method starts in a non-rational sphere and moves to the rational, where faith propels works of justice.

Scientific and religious methods then form a complementary pair of processes, sharing a common boundary of creative power. It takes creative power to have scientific insight as well as ethical insight. In both methods, a community creates the meaning. In spite of beliefs to the contrary, the scientist really does stand on the shoulders of a long tradition of discovery. In addition, the scientist is accountable to a community of peers, where the interpretation often emerges from the dialogue. The result of courageously moving across the two-way-mirror boundary from non-rational to rational (or the reverse), is the accumulation of new knowledge for one person; for the other, justice. Anselm once described theology as "faith seeking understanding." Conversely, perhaps science can be considered as "understanding seeking faith."

Conclusion

The information explosion and the accelerating pace of life affect nearly everyone on this planet in various ways. Family farms are giving way to agricultural factories; "concert-A" is higher in pitch than it used to be; people in England and North America are measurably affected by 50- and 60-Hertz power grids; more books are published in a year than all of the Western world's output up to the nineteenth century, etc. To what end is this increased pace directed? To what purpose is the accumulation of more knowledge with less wisdom?

Stopping by church after attending her Oil and Gas Resource Management Board meeting, Junika waved to the laborers heading home from their work in the villages. All her life the church was there as a light for her and her community, setting up medical care, family care for children and the elderly, organizing groups to work with industry and government. Decades earlier, the four horsemen of the post-millennial apocalypse had changed the world forever. Global epidemics coupled with crop failure from intensive monocultural practices had both taken place, along with economic implosions in the Orient and environmental disasters in Europe. People could no longer ignore history or community. People realized that complex problems could not be solved by reactionary conservatives with clever one-line analyses like the "sound bites" of an earlier era. Science and technology no longer enjoyed their radical isolation from the arena of human needs and values. There again, the highly trained clergy of the church re-entered the world of business and science that it had ignored since the thirteenth century. Business now operates with an integral understanding of the sanctity of human life and the value of communities.

Tonight was Junika's turn to lead the community in worship and the weekly meal. She looked forward to this special meal tonight, when the laborers sat down next to the merchants, students, families, and guests. The pace of the worship and the meal together reflected the pace of a world with an ancient but new-found purpose, taking one delicately slow step after another towards the Divine.

Dis-integration is far easier than integration, because both human and natural systems have a built-in tendency towards disorder and chaos in the absence of an external energy source. In communities of faith, Divine and human love is the energy countering disorder; but the powerful economic forces of contemporary Western culture have hammered the Church into irrelevance. Perhaps a mission of integration of theology and science will enable ends, motives, and purposes of the culture to be brought to the table alongside the commandment to "Love your neighbor as yourself." It is time for a new hammer.

Endnotes:

[1]All it takes is the personal experience of one earthquake of Richter magnitude 6.0 or higher to dispel this medieval notion.

[2]Literally, "the work of the people."

[3]Also known as the "undecidability theorems."

Author's dedication: "To my late uncle, Dr. Robert J. Moon of the University of Chicago, whose work on the Manhattan Project, whose radical Christianity, and whose subsequent efforts towards world peace and nuclear disarmament have been lifelong inspirations for me."

Bob Wickizer is a student in the M.Div. degree program at Episcopal Divinity School. A physicist by training, he serves on the Episcopal Church Working Group on Science, Technology & Faith.

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Rodney L. Petersen, Executive Director
The Boston Theological Institute

This second volume of *The Journal of Faith and Science Exchange* comes as Western societies and the global order that they have helped to shape arrive at the beginning of a new millennium. A dominant concern of those in the natural sciences, as well as the social sciences, is that of fostering an ethical order in the years that lie before us. It is the function of the schools that compose the Boston Theological Institute to prepare students for ethical leadership in society, primarily through religious and voluntary institutions. Leadership of this kind requires clearly articulated goals which have been thoughtfully developed, a moral integrity that reflects those goals, and the will to pursue these ideals. This volume symbolizes an attempt to foster such vision and to encourage the kind of work required of religious leadership.

For example, one of the overriding issues facing us in the new millennium is that of environmental practice and how it will shape our conceptions of consumption and population policy. Ethics in this domain is clearly being worked out in relation to scientific knowledge (facts) and religious reflection (values).[1] These categories are two parts of a whole that frame the way we view and maintain sustainability within the environment.[2] The historical era into which we are moving challenges us to formulate a new ethic appropriate to the task before us.[3] The need for additional approaches to the kinds of issues raised in this volume on the part of society at large, government agencies, and among churches and other voluntary agencies has become clear, particularly in relation to global economic structural concerns.[4] Earth's capacity to meet human demands for natural resources and, equally, its ability to absorb the waste produced by human activity, is reaching its limits.[5] In addition to the kind of integration between science and religion that is required, the following strategies (among others) might be suggested.

First, better long-range thinking is necessary to meet the environmental challenge.[6] This requires a cross-cultural scope because the nature of the problem is global. The search for a global ethic for environmental security and economic sustainability has implications for human rights.[7] Any transnational thinking requires interreligious considerations.[8] This is particularly true for reflection on The Earth Charter, which seeks to identify the core values and principles that should guide global environmental conservation and sustainable development.[9] The discussion entails derivative questions about human rights in the context of an emerging global politics, which demands that we move beyond the patterns of national interest that have dominated political thought at least since the Peace of Westphalia (1648).[10] It draws in definitions of development that affect economic well-being and reflect indigenous and other religious worldviews.[11] The discussion entails the value of all sentient life and picks up the issues raised by "deep ecology" or "eco-philosophy."[12] These are issues that require good science, as well as good reflection on the nature and origin of our values, traditionally matters of faith or religion.

Secondly, further thought needs to be given to the meaning and use of technology. "Ecology" has to do with all living species, habitats, and ecosystems; "environment" has to do with the human social, economic, and material context for life. Yet the terms are often used without discrimination or are collapsed into each other, interfering with our understanding of culture and nature. It is the premise of most theorists that the way we live in relation to these categories is both

the locus of the problem, as well as the solution. Politics and disputes about the meaning of environmental degradation become directly involved in the implications of economic action and technical deployment.[13] Our sense of the meaning and use of technology is directly related to our understanding of the meaning of human activity in the world. How we think about ourselves is reflected in the development—creation—and use of technology. Again, these are issues that draw us to the concerns of this journal.

The metaphor that seeks to tie together many of the religious traditions as they approach global sustainability is that of stewardship. Embedded in Semitic tradition and developed variously, this image emphasizes the relational context in which humanity stands with respect to the rest of nature.[14] Stewardship neither gives way to depressive determinism nor becomes overly optimistic about the spheres of human freedom open to us in the future.[15] It demands as full a knowledge of the natural world as can be discerned.

And finally, in the movement toward equity in consumption and population within the parameters of global sustainability, what encouragement is there for those who have more to give to those who have less, particularly in light of human competitiveness? The answer requires a metaphor for human self-identity and behavior such as that implied by the idea of stewardship. Without such a metaphor to relate us to God's creation, any idea of a Jubilee Year, Sabbath Restitution, or Islamic Order, as conceived in our different religious traditions, will never be realized.

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Endnotes:

1. On the role of ethics with respect to sustainability, see Engel and Engel. See also Crocker and Linden. See the debate over Act theories of ethical reflection which deny the necessity of rule theories, whether teleological or deontological, in Rosen.

2. Whyte, p. 52.

3. Ethical reflection in the churches of the twenty-first century must move more profoundly beyond the three tendencies identified by Paul Albrecht over the past seventy-five years: 1) an ethic of agapé going back to the origins of the Life and Work Movement (Stockholm, 1925); 2) a participatory and populist ethic with an overriding concern for those oppressed through racial, religious, or sexual identity; and 3) liberation theology, guided by a Marxist "science" in matters of praxis with a preference for the poor. See Albrecht.

4. See, for example, Rasmussen; van der Brent; Hallman

5. Whyte, p. 48.

6. World Commission on Environment and Development, Brundtland Report. The Report notes the rapid deterioration of the global environment as threatening human life on earth. It seeks to delineate approximate and possible ways to deal with environmental issues. It stands for: 1) meeting the needs of the present without compromising the ability of future generations to meet their needs; 2) creating a

sustainable situation for all countries; and 3) a concern for equality within and between generations, not just physical sustainability. This was the third in a series of UN reports, following the Brandt report *North-South* (1980) with its sequel *Common Crisis* (1983) and the Palme report *Common Security* (1985). It deals with major problems like the greenhouse effect, deforestation, soil loss, the debt crisis, the global commons, and the explosion of cities.

7. See Küng.

8. See Leslie. He insists that environmental issues are the national security issues of the twenty-first century. See also Huntington, pp. 130-35.

9. See Rockefeller.

10. Harrell and Kingsbury; Wapner.

11. See the papers from the conference "A Religious and Moral Challenge. Environmental Justice." A Briefing Sponsored by The National Religious Partnership for the Environment, January 9 and 10, 1995. See also *Sustainable Growth—A Contradiction in Terms?*

12. See Sylvan and Bennett. See also Skolimowski, p. 54. He develops an ecological humanism as an alternative to industrial society which sees: 1) stewardship as a prevailing metaphor for human activity in the future, 2) the world to be best conceived of as a sanctuary in a religious sense, and 3) knowledge to be defined as the intermediary between us and the creative forces of evolution.

13. I am following Goldblatt here.

14. See Coward, Part II, a survey of different religious traditions, pp. 63-194. See also Hall, pp. 103-21. In developing his ideas on stewardship, Hall contends that a form of Christian Humanism that transcends the theocentric as well as the older Liberal perspective (faulted for its assumptions about humanity and history and failure to provide an acceptable theology of nature) must be pioneered. In order to enlarge our vision of the full ramifications for stewardship, he cites the following five principles: globalization, communalization, ecologization, politicization, and futurization (pp. 122-54). See the modified or "weak" anthropocentrism of Holmes Rolston.

15. In referring to the potential latent in the metaphor of stewardship, Hall writes that as Martin Luther's vision of a justifying grace enabled people to overcome a sense of medieval guilt and thereby find the courage to live, so too "the sense of being stewards of earth and of life itself could provide a generation of world-weary and apathetic survivors some feeling of purpose" (Hall, p. 7). See his comments about the history of the book, first published in 1982, with reference to the emergence of the "Justice, Peace, and the Integrity of Creation" process in the World Council of Churches (xii). A helpful study guide is available to Hall's understanding of stewardship, written by J. Phillips Williams. Other metaphors include those of "frugality" and "mercy." On the former, see Nash; on the latter, see George H. Williams.

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What can scientific observations contribute to knowledge about God and divine action? The belief that observations of nature do inform theology is at least as old as the biblical record. Like biological evolution itself, the development of a theology of creation has been episodic, with extended periods of stability and "user satisfaction," followed by periods of innovation and change. The 1998 Essay Contest in the field of science and religion, organized by the Boston Theological Institute for graduate students in seminaries and theological programs in the Northeast U.S., has strongly encouraged such innovation and change. Working out a theology of creation is the concern of most of the award-winning essays, presented here, one that is reflective of and responsive to the vocabulary and concepts of our time. Three additional essays, by speakers from the Lecture Series of the Center for Faith and Science Exchange, provide a broader context for presenting these "evolutionary experiments" in theology to study creation and thereby learn about its Author.

Rolf Bouma opens this volume of *The Journal of Faith and Science Exchange* with his essay entitled "Patterns of Speciation and Extinction and the Divine Valuing of Creation." He challenges the often-heard anthropocentric claim that a uniquely human role in Creation is to assign value to living creatures. He makes a case for a system of valuation intrinsic within nature—pre- and, presumably, post-human—as evidenced in an ecological study of which species become extinct and which survive for continued evolution. He extrapolates from observed patterns to knowledge about the Creator's work and love for the world.

In an essay on "Theology of Creation and Natural Science," Wolfhart Pannenberg refers to his own experience of the importance of philosophy to help negotiate through the maze of misunderstandings the dialogues between science and theology. He makes the case for an effective trialogue: science and theology with philosophy, their common "cousin." In a talk given at the Massachusetts Institute of Technology, he explored how a return to the philosophical sense of "field"—which is actually the precursor of current scientific usage—might contribute to a fresh understanding of some of God's attributes.

In "Cog and the Creativity of God," Peter Heltzel probes human creativity in the field of artificial intelligence and in the fabrication of humanoid robots, and he draws conclusions about God's own creativity. Troy Catterson, in his essay, "No Time for Time," works within the formalism of quantum theories of origination to find new understanding of God's creative work.

Karl Schmitz-Moormann, in his paper on "Theory of Evolution and Faith in Creation," traces the history of the development of biological evolution as a concept, as well as the fits and starts of theology to make friends with it. The details covered in this historical overview are all too rarely included in seminary or university survey courses. Dan Kaplan looks at the fifteen-billion-year evolution of the universe as a whole and regards it as a long quest for God on the part of a cosmos that longs to know. His essay, "Fifteen Billion Years of Searching for God" shows his own delight and wonder to be a member of the search party, as well as some frustration that it progresses so very slowly.

Nicole Roskos finds some serious shortcomings in Paul's understanding of resur-

rection, in her essay, "The Missing Face of Ecology in Pauline Theology." She argues for reclaiming the scientifically sound ecological relationship of earth and earthling, as found in Genesis. She points up the positive theological view of death found in the Creation stories, which is gone by the time of Paul's writings.

The reductionism of contemporary neuroscience and its clash with theology is the subject of Andrew Irvine's study. His essay, "Limit Conditions on an Encounter of Theology with Neuroscience," looks at a possible resolution in the dispute over beliefs and claims regarding personhood and soul.

In the only essay concerning the social sciences, Andrew Irvine presents the classic critiques of "old time religion" (biblical literalism) leveled by "old time psychology." Itself the object of postmodern critique, psychology has examined the cultural context of its own beginnings. Fundamentalism is now being reassessed as a sort of buffering strategy used by some communities for cultural preservation.

At the close of his essay, Karl Schmitz-Moormann observes, "[t]he question of whether, in the long run, theology can survive while continuing to ignore the results of science, especially evolution, has yet to be answered." The scholars who have contributed their work to this volume are clearly engaged in the enterprise to help our religious traditions respond, adapt, evolve, survive—and thrive.

NOTE: The Boston Theological Institute and the Center for Faith and Science Exchange express their gratitude to the John Templeton Foundation for the grant that supported the 1998 Student Essay Contest in Science and Religion. This program has encouraged the innovative work of graduate students in an important field of research, development, and application.

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Patterns of Speciation and Extinction and the Divine Valuing of Creation

Rolf Bouma

The near-universal concern over the current rate of species extinction must be contextualized, given the occurrence of previous mass extinctions during the course of Earth's natural history. Current scientific knowledge regarding patterns of speciation and extinction present two challenges to the theologian: 1) how to understand God's relationship to these patterns; and 2) how to understand God's valuation of transient creatures in creation. After reviewing current theories regarding speciation and extinction, the implications for theology are addressed, particularly the need to account for extinction as an undeniable feature of cosmic history.

The world's species are in serious decline, a situation simple to detail even if figures are less than precise. Somewhere between 5 and 40 million species of living creatures populate the earth. Estimates place the present rate of extinction at up to 50,000 species per year. According to the latest *State of the World* publication, "[t]hree fourths of the world's bird species are declining, and nearly one fourth of the 4,600 species of mammals are threatened with extinction."[1] Prime factors in current extinctions are loss of habitat (e.g., destruction of rain forests) and ecosystem disruption (e.g., introduction of non-native species, overharvesting).

Whether from a "shallow" anthropocentrism or a "deep" ecocentrism, concerns abound.[2] At the very least, the richness of biological resources available for human use and enjoyment is in serious jeopardy. On a larger scale, there is a sense that something "out there" (God, the universe, the web of life—to name a few candidates) is being shortchanged in the narrowing of biological diversity. Of added concern is the human role in the situation, as "[f]or the first time, a single species—*Homo sapiens*—has become a vast, destructive ecological force."[3]

Concerns, however, must be contextualized, and contextualization is a dicey business. Simply put, what context? If historical perspective is considered to be coterminous with human history, then trends are clearly new and alarming. An unprecedented extinction event requires prompt attention and action. When placed in cosmic historical perspective, however, the issues become murkier. What if, as seems to be the case, this is not the first period of mass extinction, but merely the latest of a number of such periods? Does precedence diminish concern, or does historical inquiry push past precedence to find the unprecedented in this period of extinction (e.g., the human factor), and thus foster rather than inhibit concern and action?

Religious voices increasingly insist that proper respect for divine artistry demands protection of endangered species.[4] What sort of warrant is there for a religious ethic regarding endangered species? Ethics from an ecological perspective often operates on the principle that "what ought to be is derived from what is."[5] What "is," so far as nature/creation is concerned? This essay will outline patterns of speciation and extinction, then examine theories regarding those patterns, particularly as they influence the theist's concept of the nature and direction of God's activity in this world and our valuation of the world.

Historical notions of species appearance and disappearance

That species appeared and vanished was a relatively novel idea in the 1700s. Jewish and Christian traditions claimed one primary act of creation, and for much of Western history there was no reason to challenge the idea that, once created, the orders of living things remained fixed. The position that individual channels of overflowing divine goodness as exemplified in God's creatures might stop flowing was inconsistent with God's infinitude and ongoing concern for creation.[6]

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The emergence of fossil remains as a subject of scientific and religious discussions in the eighteenth century required new conceptions. The prevailing viewpoint became old earth catastrophism, in which an ancient earth experienced several epochs of creation of biological forms, each epoch coming to a complete end through catastrophe with no carry-over of species from one epoch to another. Typically this was combined with a belief that some past processes either no longer operated in the present or operated at a diminished level.[7]

Following the lead of Charles Lyell in geology, Charles Darwin challenged these assumptions in the mid-1800s with his model of speciation, characterized by uniformity of process and incremental changes in life forms, with the gradual emergence of new species over extended periods of time. Darwin's was primarily a model of speciation, with extinction handled by auxiliary hypotheses. For Darwin, species might disappear in one of two ways: 1) a species might linger long enough to register upon the fossil record, yet ultimately prove to be a loser in the struggle for survival and truly become extinct; or 2) a species might evolve into a significantly different form (a process known as "pseudo-extinction"). In either case, the end result was the presence of a particular form in the fossil record and its absence in the current panoply of living species.

Key to Darwin's theory is the matter of incremental change, and at this point Darwin met his most substantial challenge. The fossil record, exhibiting fits and starts, left major gaps to be filled in imaginatively. The imagination fired by Darwinian theory saw a procession and progression filling in the gaps through a steady, inexorable diversification of the biotic community. To skeptics, however, the list of species leaving the tail-end of one segment of the fossil record so differs from that which begins the next that it seemed improbable that Darwinian evolution could account for the dramatic difference.

Current concepts

Current theories suggest that forms of life on earth coalesced approximately 3.5 billion years ago, with animals emerging somewhat less than a billion years ago. Today's significantly broader data from the fossil record challenges Darwinian evolutionary theory, since neither speciation nor extinction seem to occur incrementally—which in turn has raised questions about the uniformity of natural processes.

Speciation seems to occur fitfully, with long periods of stability punctuated by periods of rapid appearance of new species. Why the explosion in speciation at some times, and the dearth of it in others? Com-

menting on the explosion of speciation during a 5-to-10-million-year segment of the Cambrian period and the fact that subsequent periods do not show a similar explosion, Richard Leakey writes:

> It was as if the facility for making evolutionary leaps that produced major functional novelties—the basis of new phyla—had somehow been lost when the Cambrian period came to an end. It was as if the mainspring of evolution had lost some of its power.[8]

Extinctions similarly punctuate the record. While the number of species in existence at a given time has increased overall, the fossil record exhibits a series of extinctions of moderate degree in which 15 to 40 percent of animal species disappeared. On five occasions,[9] massive extinctions appear to have taken place in which 65 to 95% of all animal species disappeared. As Richard Leakey describes it:

> The Big Five [extinctions] interrupted that rise [of diversity] to dangerously low levels.... This handful of major events, from oldest to most recent, are: the end-Ordovician (440 million years ago), the Late Devonian (365 million years ago), the end-Permian (225 million years ago), the end-Triassic (210 million years ago), and the end-Cretaceous (65 million years ago).[10]

The resulting pattern of species development highlights two seemingly contradictory facts: 1) The present geological period has the highest species diversity within natural historical time (at least prior to the current period of extinction related to human causes); and 2) virtually all species no longer exist. Leakey notes:

> Some thirty billion species are estimated to have lived since multicellular creatures first evolved in the Cambrian explosion. According to some estimates, thirty million species populate today's Earth. This means that 99.9 percent of all species that have ever lived are extinct. As one statistical wag put it, "To a first approximation, all species are extinct."[11]

A number of culprits have been identified for precipitating mass extinction, with the most likely candidates considered to be meteorite impact and/or volcanism with concomitant changes in climate and sea levels. Since 1980, the darling of catastrophes has been meteorite impact, with the suggestion that the impact of a large meteorite (diameter >10 km) disrupted global ecosystems and led to mass extinction some 65 million years ago. Primary evidence for this theory is the high level of the element iridium found at the K/T boundary,[12] but other evidence points in this direction as well.

Does this theory account for one mass extinction or many? While the main focus has been on the dinosaur extinction of the Cretaceous period, some scientists have pushed the theory further. David Raup, among others, considers the claim that all extinctions are the result of meteorite impact and subsequent systemic disruption, and further, that these extinctions happen periodically at intervals of approximately 26 million years.[13] Extinction would thereby be catastrophic and periodic. Raup himself is tentative with this proposal, and few scientists consider it likely.

A close cousin to impact theory is that of volcanism.[14] Volcanic eruption can seriously disrupt the earth's ecosystem, as well attested in the 1991 eruption of Mt. Pinatubo in the Philippines. If volcanic activity increases substantially, climate change occurs at a rate faster than organisms can adapt. Volcanism may also account for high iridium levels at those points in the geological record that coincide with mass extinctions.[15]

Beyond these catastrophic disruptions, attention focuses on population patterns themselves. Contemporary ecological theory emphasizes the interrelatedness of species within ecosystems. The loss of a few key species can collapse an entire ecosystem, resulting in the loss of almost all its species.[16] Species population rarely remains constant for any length of time, and patterns of fluctuation are difficult to decipher. Is there a descriptive regularity to population patterns? The simple relationship once

thought to exist between food/prey and predators is actually quite complex. Not only do population patterns fluctuate wildly, but it is highly suspected that population patterns are chaotic.[17] Natural fluctuations occasionally bring population levels down to the lower end of survivability. As David Raup puts it, extinction can be as much the product of bad luck as of bad genes.

> One of the legacies of the Darwinian revolution imposed a very particular view of the world on Western intellectual thought. According to that perspective, species thrive because they are superior in some way to their competitors; they win in the "struggle for existence," to use Darwin's phrase. Similarly, species go extinct through succumbing to competition; they are failures in life's struggle.... But one of the more important developments of evolutionary biology in recent years is the recognition that luck, not superiority, plays a cogent role in determining which organisms survive, especially through times of mass extinction.[18]

Difficulties with the twin pillars of classical Darwinism—uniformitarianism and incremental change—have become substantial enough to bring them renewed scrutiny as central organizing principles of evolutionary theory. While Darwinian evolution has not been unseated from its preferred position in the scientific community, catastrophism has reclaimed a major place in the explanation of extinction and subsequent re-speciation.[19] Catastrophes precipitate crises among species, with a resulting disintegration of entire ecosystems. This claim then links to a second, in which the suddenly-open playing field brought on by mass extinction results in an explosion of new forms. A larger number of complex creatures emerges in a shorter period of time than would be predicted under a Darwinian evolutionary scheme. Further, the forms that emerge in an explosion of speciation do not necessarily resemble those of the previous extinction. Principles of complex organization seem to play a role. The quest and the question is not only to discover the principles, but also why they seem to operate at one time and not at another.

Evolution, theology, and ecological ethics

What effect does recent scholarship have upon theology and the understanding of God's ways with this world, particularly in relationship to species? Two major reconsiderations should take place. First, theology should describe God's relationship to the world in such a way as to account for extinction as well as rapid speciation. Divine design arguments certainly cannot be framed as they were in the seventeenth century, nor even as they were in the past century, where theology accommodated evolution by allowing God's design to blaze a path of progress. If "design" is perceived too tightly, it is difficult to avoid the conclusion that God wasn't overly-enamored with certain efforts, having followed several different design projects and seen fit to abandon some of these in midstream. Such a scenario gives an interesting slant to Van Gogh's conjecture that the world was "a study that didn't come off."[20]

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It is still possible, however, to speak of divine design in coherent fashion. There has to be some looseness allowed, with God's design establishing parameters and marking

the channels through which random generation and transmutation of forms may take place. There is a discernible trajectory of increasing complexity and diversity even though this trajectory is intermittent and scattered. Clearly organisms increase in complexity at a variety of levels. Diversity over time increases. Sentience emerges. Occasional mass extinctions seem to operate as wildfires do in ecosystems, to clear the landscape for a profusion of new forms. Extinctions are contextual. As Holmes Rolston states:

> Even species come and go, over millions of years.... The half-life of a species is typically upward of ten million years. Some become extinct without issue, but nature's long-standing trends transform others and increase the numbers of species present in each later epoch, as well as their richness.... Even the few crashes and mass extinctions, though setbacks, have reset life's direction.... Retrenchments in the quantity of life were followed by explosive inventiveness in its quality.[22]

Under such a view, theology laments the current extinction not simply because it opposes an overall trajectory and pauperizes a world which God steers toward richness, but also because there is no clearing for new forms to flourish in a world hoarded by humanity.

Secondly, theology needs to understand value in a way that does justice to the "temporal" as well as the "eternal". That something endures through time might be a consideration in its value, but not its chief determiner. Failure to appreciate this has led theology to value the soul disproportionately over the body, the human over the animal, and to assume that God values only that which endures. With this in mind, theology which took a Darwinian approach felt obligated to move God's concern for all creatures from the individual to the species. Tennyson observed, "So careful of the type [Nature] seems, so careless of the single life,"[23] which was an echoing of Mary Wollstonecraft's theological observation that "[i]t is the preservation of the species, not of individuals, which appears to be the design of Deity throughout the whole of nature."[24] Tennyson, like Wollstonecraft, was wrong. If profligate with individuals, then creation is profligate with species as well. It is difficult to see how current knowledge suggests a divine preference for species over individuals.

The answer is not to consider God as disvaluing both, but to understand that a more complex valuational scheme pays attention to various structural levels in the world. Theology must develop a nuanced understanding of divine valuation. In this regard, contemporary ecological theory is helpful as it cautions not to isolate value at one level. Just as the physical world has the three dimensions of space and the fourth dimension of time, so valuation needs to take into account the three dimensions of individuals, species, and systems, joining these together with the dimension of process (time).[25] Rather than demand pre-eminence for one of these dimensions (as is evident, for instance, in the animal rights movement's concern for the individual and its allegation of speciesism against any consideration on the species level), consideration of the value inherent within and instrumentally joining the parts of creation leads us to see the val-

That something endures through time might be a consideration in its value, but not its chief determiner. Failure to appreciate this has led theology to value the soul disproportionately over the body, the human over the animal, and to assume that God values only that which endures.

ues present at various levels. Thus, species are valuable not only as the form through which individual lives flow, but as parts of systems in which the presence of a species shapes and moves the system and its components along an uncharted path.

Conclusion

Endangered species preservation is an ethical issue that requires adequate scientific knowledge as well as theologically informed ethical principles. Theology and science can interact constructively in this regard to avoid either oversimplification on one hand, or a bafflement which precludes action on the other. Fortunately, the complexity of science's description of speciation and extinction patterns can be matched by theology in its description of God's connections to and desires for the world. Theology's peculiar power is to provide a conceptual framework for understanding the present dilemma of species extinction by drawing us outside ourselves and our fixation on purely human pursuits that leads to catastrophe for others of God's creatures. Theology enables us to perceive the nature of God's connection to the world and the ways in which God channels value through the creation. That perception is an integral part of addressing the current crisis in species extinction and cutting short a catastrophe of human origin.

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Endnotes:

1. Brown et al., p. 13. Estimates of present extinction rates vary widely, with common portrayals of "one species per day" or "three species per day." Extinction estimates are the result of multiple factors, such as the number of species per hectare, the average range per species, and the rate of habitat destruction.

2. For a history of the "shallow" and "deep" designations made popular by Arne Naess, see Session, pp. ix-xiv.

3. *State of the World*, p. 13.

4. From an evangelical perspective, see the articles in *Green Cross*, Vol. 2:1 (Winter, 1996).

5. Rolston, p. 58. This principle is disputed by some philosophers and theologians as an impermissible deviation from the ethical norm that What ought to be can never be derived from what is.

6. Carl Linnaeus, the father of modern taxonomy, wrote in his *Philosophia Botanica* of 1751: "There are as many species as the infinite being created diverse forms in the beginning, which, following the laws of generation, produced as many others but always similar to them. Therefore, there are as many species as we have different structures before us today." Cited in Hsü, p. 218.

7. Ratsch, pp. 15-16

8. Leakey and Lewin, p. 27.

9. The exact number of mass extinctions is contested. William Glen, for instance, claims evidence for up to twelve periods of mass extinction. Glen, p. 25.

10. Leakey, p. 45.

11. Ibid., p. 39.

12. Iridium is an element in the platinum family which, due to its "iron-loving" qualities, sank to the center of the planet in the early stages of earth's development. Its presence at the K/T boundary, the juncture between the Cretaceous Period (dinosaurs and conifers) and the Tertiary Period (the modern era of mammals and flowering plants) is strongly suggestive of meteorite impact.

13. See Glen, pp. 26-29, for a history of discussions about extinction and periodicity.

14. For the argument for volcanism and against impact theory, see Officer and Page, pp. 158-77.

15. Iridium is also consistent with volcanism, but only with deep core volcanoes. Most volcanoes are shallow and form at the edge of surface plates. Volcanoes at the center of plates tend to be fewer, but deeper.

16. Jablonski, p. 39.

17. See Leakey and Lewin, pp. 149-170. One difficulty is that "chaos" is a popularly invoked concept, although it is difficult to prove. As has been pointed out, "chaos, sufficiently complicated periodicity, and what [is] called strict randomness...can rarely be phenomenologically distinguished from each other...." Wildman and Russell, p. 78.

18. Ibid., 17-18.

19. There are, of course, those who refuse to give up on uniformitarianism, and see in catastrophism a return to pre-Darwinian ignorance. Briggs, pp. 230-36. It must be admitted that neither is the fossil record sufficiently complete nor are dating methods sufficiently precise to settle conclusively the question of the swiftness of past mass extinctions.

20. Quoted in Dillard, p. 69. Dillard takes issue with Van Gogh's comment, but only because her sense of God's profligacy is matched by her awe at the intricacy of God's work.

21. Barbour, p. 238.

22. Rolston, p. 221.

23. Tennyson, Prologue 55, st. 2.

24. Wollstonecraft, Letter 19.

25. See Rolston, pp. 192-245. Few scholars have explored the notion of value in regard to the natural world as extensively as Rolston.

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This essay received a First Prize and the Grand Prize.

Theology of Creation and Natural Science

Wolfhart Pannenberg

The author advocates for the mediating role of philosophy in the dialogues between science and theology, in particular, the dialogues to clarify that the creation of biblical faith is the same entity as the cosmos of scientific study. He points out that most current scientific concepts, such as 'field,' have a prior history of usage in philosophical discourse, before being modified for usage in scientific contexts. This example, together with associated concepts, holds special promise for developing a contemporary theology of divine presence and action.

Introduction: philosophy's role in the dialogue between theology and the natural sciences

Half a century ago, Karl Barth wrote in the preface to his treatment of creation in his *Church Dogmatics* that there are "absolutely no scientific questions, objections or supports concerning what scripture and the Christian church understand to be God's work of creation."[1] Such a restriction of the theology of creation to a "retelling" of what the Bible tells us about this subject has its price, and the price to be paid here was that it could no longer be made clear just how far the biblical faith in creation means the same world that the human race now inhabits and that is described by modern science. The affirmation that the God of the Bible created the world degenerates into an empty formula, and that very biblical God becomes a powerless phantom if no longer understood as the one who originates and completes the world as it is given to our experience. For this reason, one should not agree with Barth, but rather with Karl Heim, in his attempt to relate theological affirmations about the creation and final consummation of the world to the respective conceptions of contemporary science. In the context of Anglican theology, a theological appropriation of Darwin's doctrine of evolution was developed as early as 1889, in the famous volume *Lux Mundi*, edited by Charles Gore, where the biblical conception of a history of salvation, culminating in the event of incarnation, was combined with the modern evolutionary perspective. This view has been effective into the present day, together with related ideas issuing from the work of Teilhard de Chardin.

In spite of all the difficulties of a theological interpretation of the natural world, Christian theology must not evade the task of interpreting the same world that is described by scientists to be, in fact, the creation of God. It is not enough simply to declare the world to be God's creation; such a theological affirmation has to be made plausible. This is not to suggest that theology should enter the discussions among scientists on their level of scientific description and theory. Theological interpretation of the world of nature in terms of creation cannot be presented as competing with physics or with any other natural science. Claims like that are excluded by the fact that theological arguments move on another methodological level than the hypotheses of natu-

ral law in the sciences do, with their examination by experiment. From a theological perspective, the reality of the world presents itself in the form of a unique and irreversible historical process which is the result and expression of divine action. Certainly, in the process of this history, there emerge uniformities and structural types of sequences of natural events that correspond to the scientific concept of natural law. In the book of Genesis, after the story on the flood, it says: "As long as the earth endures, seedtime and harvest, cold and heat, summer and winter, day and night, shall not cease."[2] Such regularities of natural processes, however, are themselves considered as products of a unique divine decision, not as evidence of a timeless order of nature. The theological focus on the historically unique and on the irreversible process of history is also related to the fact that theology does not conceive of space and time in the sense of homogeneous sequences of spatial and temporal units, sequences that can be geometrically constructed, counted and measured. The mathematical form of representing and describing natural processes and the scientific concept of law belong together. The absence of mathematical description in theology, on the other hand, speaks not merely to the inability of theologians, but also to the peculiarity of the theological subject matter and its appropriate treatment.

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Now, the question arises, whether theology exemplifies a qualitative mode of describing reality, a mode that has been reduced so often in the history of modern science to a quantitative and, consequently, mathematical way of description. The ideas of the biblical reports on creation, about the sequence in the emergence of natural forms, have been indeed replaced in modern science by conceptions based on quantitative descriptions of processes regulated by natural law. Should this tendency be generally valid concerning the relationship between theology and science? Professor Frank Tipler, mathematical physicist at Tulane University, claims in his recent book, *The Physics of Immortality*, that theology finally has to be absorbed into physics. He tries to show that the history of the universe tends towards an omega point, characterized by peculiar properties of the traditional concept of God, and which functions not only as the result but also as the creative origin of the movement of the universe. It is, therefore, occasion for an identical repetition of all forms of intelligent life in the dimension of eternity. Tipler accounts for these claims by a proposed theory of scientific cosmology. The educated layman cannot help being impressed, but he or she is also impressed by the multitude of different models of scientific cosmology produced over recent decades. Cosmology, to all appearance, is a highly speculative discipline. But how is theology to be expected to relate to the possibility of those arguments?

I think that attempted transformations of theology into physics should be observed with curiosity on the one hand, but also with a certain degree of skepticism on the other. Curiosity and openness are appropriate, since even tentative constructions of this kind work against the widespread prejudice that theological and scientific conceptions are unrelated—a prejudice the effect of which is usually that theology seems to be

irrelevant concerning our understanding of the reality of the world we inhabit. Skepticism, however, is appropriate, because of the apparent incommensurability between the scientific conception of natural law and the theological approach to reality. Could, indeed, the conception of the world in terms of a unique and irreversible history of ever new and contingent events—including the idea of God providing their origin, and of Christian eschatological hope—be dissolved, without important remnant, into a description of the world process in terms of natural law?

Even at this point, I see no basis for theological anxieties. After all, there is the historical parallel of Aristotelian physics, the objects of which included the existence of God, though not a future resurrection of the dead. A proper conception of God as creative origin of the natural universe, to be sure, had to describe the creation of the world by starting from God as origin of it, rather than dealing with God as an exponent of the cosmic process. In Christian theology, such a comprehensive knowledge of creation that would comprise all the different aspects of created reality is not expected before the final consummation of the world, in connection with the eschatological vision of the glorified ones. Until then, it seems likely that human knowledge about the world will develop under conditions of human finitude and, therefore, in the form of conjectures only, and by way of their examination and revision. In a reverse argument, Christian theology seeks to conceive of God as creator of the world on the basis of the revelation in Jesus Christ. But in doing this, theology is not in a position to explain in detail the processes in the natural world.

The aim of reaching an agreement between the theology of creation, on the one hand, and the scientific knowledge about the world of nature on the other, may be indicated, then, more properly by the term *consonance* between the two perspectives than by any sort of reduction of one of them to the other. Consonance presupposes the absence of contradiction. But it requires more than that. Contradictions can be absent simply because ideas stand unrelated to each other. Consonance, however, implies the image of some harmony and, consequently, of a positive relationship. How can such a consonance be claimed with respect to affirmations that belong to quite different methodological levels? In such a case, it is necessary to look for a third level to which the two others are related. In the case of the dialogue between science and theology, such a third level has, indeed, always existed. It is the level of philosophy.

It is not enough simply to declare the world to be God's creation, but such a theological affirmation has to be made plausible. This is not to suggest that theology should enter the discussions among scientists on their level of scientific description and theory.

Whenever scientists talk about the relevance of their findings and theoretical formulas in view of the understanding of reality, they move in the medium of philosophical reflection on procedures and results of their science, and not, in the strict sense, on the level of scientific argument. Reflections on the relationship between natural law and the contingency of events, between causality and freedom, matter and energy, the concepts of time and space or evolution, take place inevitably in a medium that is impregnated with philosophical language and its history. Furthermore, in most cases, key con-

cepts of science have philosophical origins and underwent modifications in order to fit the requirements of their use in science. Recent investigations into the history of scientific concepts, such as space, time, mass, force and field, demonstrated connections between the philosophical meaning of these concepts and their scientific use. Therefore, together with familiarity with the philosophical discussions on these subjects, a degree of knowledge in the history of science and especially about the history of scientific terminology is a presupposition of a productive dialogue between theology and the sciences.

Christian theology, on the other hand, during the entire course of its history, has developed in close connection with philosophy, though the relationship was not without its complications and strains. In contrast to this situation with the sciences, the relationship of theology to philosophy is not, in the first place, a matter of philosophical origins of a particular terminology. Rather, it is a task of integrating into theology and its explication of the relation of the God the creator and redeemer of the world and humanity, the philosophical language about God, the world and the place of human beings in it. Such integration of philosophical theses and conceptions into Christian theology always meant a more or less incisive transformation of the philosophical meaning, and occasional tensions between theology and philosophy in the course of history often arose from such attempts at appropriation. Theology, however, in affirming the abiding truth of the biblical God and of divine revelation as concerning every human being, always depended, and will continue to depend, on the rational universality of philosophy. Therefore, it had to assimilate into itself not only the philosophical doctrines of God, but also the philosophical affirmations about the world and human beings. At this point, it finally becomes apparent just how important the relationship to the philosophical interpretation of the world becomes, as the basis of a dialogue between the sciences and Christian theology. The inclusion of scientific considerations and results into a reflection upon how to perceive of reality at large—and of the situation of human beings in the world—is not the first and sole subject of a theological doctrine of creation. That has always belonged to the philosophical interpretation of the world. In its task of critical appropriation and assimilation of the philosophical view of the world, theology always dealt implicitly with the knowledge of nature given through science. However, the theological transformation of philosophical concepts of the world has to be evaluated just as philosophical hypotheses themselves are—namely, by their ability to do justice to scientific views and results.

In most cases, key concepts of science have philosophical origins and underwent modifications in order to fit the requirements of their use in science.... Therefore, a degree of knowledge in the history of science and especially about the history of scientific terminology is a presupposition of a productive dialogue between theology and the sciences.

Unfortunately, the task of the philosophy of nature and of its integrative reflection of scientific descriptions of nature is now neglected by most philosophers. The resulting gap is often filled by natural scientists, who, from the perspective of their respective discipline, offer generalized philosophical reflections and conjectures concerning the world at large. In this connection, however, the horizon of philosophical problems connected with the respective subject

matters and the history of those philosophical problems is often not appropriately considered. It these cases, it becomes the task of theologians to be in dialogue with natural scientists, to remind them of the philosophical problems involved in the subject matter of such dialogues, and to argue, within such a framework, for the specifically theological concerns.

The purpose of the rest of this paper is to exemplify what has been said so far in general terms concerning the dialogue between theology and science, in relation to a number of specific issues that appear to me as particularly important for such a dialogue, because they are important in the foundation of any interpretation of the world. In the first place, some reflections on the concept of law seem to be appropriate, and this in relation to the correlate of law in what is contingently given. The correlation of these two aspects in describing natural processes can be shown in the concept of natural law itself, but this also offers the opportunity for Christian theology to relate the specifically biblical understanding of reality to the description of nature by laws and formulas. A second consideration shall focus on the ideas of space and time, which are not only basic in science, but also important in theological affirmations on God's relationship to the world. A third question will deal with the relationship of affirmations about God and divine activity to the motion of bodies, their development and decay. This is the classical theme of scientific descriptions of nature in the framework given by the ideas of space and time. A clarification of how the idea of God relates to space and time, therefore, may have consequences for an understanding of created existence and movement within space and time in their relationship to God. In this connection finally certain conclusions will arise in relation to the concept of evolution, but not only with respect to the evolution of organic life, but also to its setting in the history of the universe.

If there was a point on which modern philosophical theology was in unanimous agreement with the earlier scholastic teaching about God, it was the affirmation that God cannot be a body.

The concept of nature's laws

In 1970, I wrote an article called "Contingency and Natural Law." The topic had been under close discussion for a number of years in a circle of physicists and theologians in Heidelberg, Germany, and my ideas had undergone considerable modification as a result of these discussions. The subject was interesting from the theological perspective, because the Biblical reports on God's action in history emphasize the element of the new and unexpected in divine actions, an emphasis that also characterizes the action of God in the creation of the world. The history of God's action constitutes a unique and irreversible sequence of such contingent acts.

The concept of contingency that is used to characterize divine action in history has its philosophical origin in Aristotle. There it refers to what occurs by chance and to what is non-essential but possible, in contrast to what is necessary. In Aristotle, however, contingency was connected with the concept of matter; while medieval Christian Aristotelianism, especially since Duns Scotus, connected it with God's freedom of will and action.

The concept of natural law, on the other hand, is logically related to conditions of its application that are contingent in relation to the formula of law as such, to initial conditions, and to marginal conditions of the processes described by a formula of law. Those initial and marginal conditions can them-

selves result from processes that, in their turn, may be described by formulas of law. This does not change the basic fact, however, that each such description again presupposes contingent conditions of its application, with the effect that laws of nature may be conceived as descriptions of certain uniformities in natural processes that occur in what is, basically, contingently given. This implies the assumption that all events are contingent in the first place, even when the sequence of events shows similarities or uniform structures.

This consequence appeared to the natural scientists participating in the above-mentioned discussions at Heidelberg in the 1960s as rather problematic, although such an assumption is also suggested by the irreversibility of time. In the meantime, the contingency of events, in distinction from contingency in a merely logical sense, seems to be generally accepted, in view of the fact that many natural processes take place in chaotic forms. The contingency of events can be affirmed especially with relation to the indeterminacy of elementary events in quantum physics, provided that account is taken of the fact that the same events, on account of the uniformities in their sequence, also become objects of descriptions in terms of natural law. The possibility of such description, on the other hand, does not eliminate the fundamental contingency of events; rather, the regularities that can be observed in contingent sequences of events and that can be described by hypotheses are themselves contingent facts. But, while theological affirmations concerning the reality of created existence and the action of God in creation are primarily related to this aspect of contingency in natural processes, a scientific description of these natural processes is primarily concerned with the demonstration of regularities in those processes. However, the dependence on something contingently given is a precondition in the applicability of the concept of law itself.

To those involved in the Heidelberg discussions, a common basis for the dialogue between theology and nature seemed to emerge from the clarification of the correlation between natural law and contingency, a common basis beyond vague analogies and metaphors transferred from one discipline to the other. Nevertheless, the agreement on the correlation of natural law and contingency did not open access to a more concrete understanding of nature in theological perspective. In order to find the key to that access, a theological approach had to be developed to fundamental concepts of physics, such as energy or force or movement, as well as to their presupposition in ideas about space and time.

The concepts of space and time

In the early eighteenth century, a philosophical dispute concerning the concept of space took place in which theological implications played a decisive role. Even today, the correspondence between Leibniz and Samuel Clarke[3] on Newton's description of space as *sensorium Dei* in his *Opticks* holds more than merely historical interest. Certainly, Newton's concept of absolute space has become obsolete since Einstein's theory of relativity, but Newton's thought about space and about God's relation to space was very complex. It is worthwhile to take a closer look, in order to find out just how many of these ideas have become obsolete and how many have not. The conceptions of absolute direction in space and of absolute dimensions of objects in space are certainly no longer valid. But Newton's and Clarke's ideas about God's relation to space contain another insight that is still important. Clarke defended Newton's attribution of the concept of space to the idea of God against Leibniz' objection that God, in such a case, would be divisible and composed of parts. Clarke's main argument was that all division in space already presupposes space, because division can only take place within space. The space that is presupposed in all spatial division is infinite and undi-

vided; and it is this infinite space, not geometrical space, composed of parts, that is said to be identical with the divine immensity that enables God to be present to every creature at its own place. This argument was reproduced by Kant in his *Critique of Pure Reason* in 1781. According to Kant, the intuition of space as an infinite whole is presupposed in any conception of determinate spaces.[4] Kant stopped exploring the theological implications of this idea, because he conceived of space as a merely subjective form of human intuition. As soon as one wonders about this subjectivism, however, as did Samuel Alexander in this century, then the theological implications of the priority of infinite and undivided space in relation to every determinate concept of spaces reemerges before one's eyes. The point of this argument is that the infinite space that is presupposed in each division of space is necessarily undivided, in contrast to all geometrical conceptions of space.

Geometrical concepts of space are constructed on the basis of units of measurement: each geometrical unit of measurement is itself a unit of space, the concept of which presupposes the undivided whole of infinite space. That, however, is an infinity that is not to be conceived the same way as in geometry—by indefinitely repeated addition of units of measurement—but an infinity that is prior to all division and, therefore, also prior to all forms of measurement. The mistake that Spinoza made in his conception of space as an attribute of divine substance consists in the fact that he did not distinguish infinite geometrical space from the infinite undivided space of the divine immensity—which is presupposed in every geometry. If this distinction is considered, then no pantheistic consequences result from such a close connection between God and space, consequences that Leibniz seems to have suspected in Newton's thought. The transition from the undivided space of divine immensity to the space of our experience that knows of parts and places can be considered, then, a consequence of the occurrence of finite objects and their relations to each other. In such a way one can also do justice to the relativity of spatial relations, with regard to the masses moving in space. Each type of space that consists of parts presupposes, as Kant emphasized, some undivided *whole* of space, because divisions and parts are only possible within some space that is already there and, therefore, *prior to* geometrical conceptions of space. The ideas about divine immensity and God's omnipresence with every creature can be referred to this presupposition of undivided space, as Newton and Clarke did, without violating the divine transcendence over the world. This contrasts with Spinoza's conceptualization, which Einstein felt sympathetic with, by the way, but which did not distinguish between the undivided infinite space of divine omnipresence and the space of geometry.

One of the most renowned historians of science in our century, Max Jammer, who investigated the history of a number of key concepts of physics, considers the* pneuma *concepts of classical antiquity as predecessors of the field concepts of modern physics.

The relationship between God's eternity and time is largely analogous to that between God's immensity and space. Kant's treatment of time in his transcendental aesthetics corresponded closely to his treatment of the idea of space. In both cases, an infinite and undivided whole is considered the precondition of all division and of all concep-

tions of parts. With reference to time this means, "Different times are but parts of one and the same time"[5] The undivided whole of time, or, rather, the whole of life that appears divided in the sequence of time, has been termed 'eternity' in the philosophical and theological tradition, ever since the treatise on time by Plotinus (3rd century C.E.) in his *Enneads*. Eternity, Plotinus says, is ultimate completion without parts or division of what occurs in divided form in the sequence of time.[6] Boethius (d. 524 C.E.), who transmitted this definition to later generations, called eternity the simultaneous and complete presence of unlimited life.[7] Eternity, then, is not atemporal or timeless in the sense that eternity and time were completely foreign to each other. Rather, according to Plotinus, time is constituted by eternity, because the transition from one temporal moment to the next is understandable only if we presuppose some presence of the whole that is separated in the sequence of temporal moments even within that separation—in other words, a presence of eternity in the course of time itself. The same idea is expressed in Kant's sentence: different times are just parts of one and the same time. However, Kant did not view time as constituted by the presence of eternity; but, in analogy to his conception of space, he thought time to be constituted on the subject of experience—more precisely, on the "standing and persisting" human ego, which, as persisting through time, according to Kant, forms the basis of the unity of all human experience.[8] In view of the temporality of the ego itself, however, which we are aware of in our self-consciousness, Kant's attempt of accounting for the unity of time on the basis of the unity of the subject may seem to be considerably more problematic than Plotinus' foundation of time on the concept of eternity.

From a theological perspective of nature, then, God's eternity is present in time, more specifically, as origin and completion of time and of all temporal reality: origin in the sense of conditioning the continuity of what occurs separately in the sequence of time; completion, however, because all temporal reality, according to Plotinus, tends toward the future, in order to realize the wholeness of its being. It is through the future that eternity enters into time.

With respect to time as well as to space, the result is that these ideas cannot be successfully defined on the basis of measurement by clocks or by spatial units of measurement. This may be a very important point in the dialogue between theology and science, because the scientific interest in time, as well as in spatial dimensions, is so closely connected with the possibility of measurement. The ideas of space and time, however, claim priority over those regarding measurement techniques. If this priority is neglected, contradictions will be the inevitable consequence. This is so, because all units of measurement are themselves already parts of time and space that have to be delimited within time and space from other such parts and, therefore, already presuppose time and space as such.

Motion, force, and field

Much more difficult than the question of the relationship of space and time to God's immensity and eternity is a clarification of God's relation to the forces working in the motions of nature. And yet, this is a decisive question for every biblically based doctrine of creation, because at this point the possibility of God's action in creation is at stake, action not only in the beginning, but also in the entire process of the history of creation. It was at this point that, in the seventeenth and eighteenth century, the alienation between Christian theology and the scientific description of nature began. The starting point of this alienation was the mechanistic interpretation of natural processes. Descartes inaugurated it and it triumphed against Newton's intentions in the eighteenth century, when all natural force was reduced to bodies and to

their effects upon each other. This conception necessarily excluded God from the understanding of natural processes. If there was a point on which modern philosophical theology was in unanimous agreement with the earlier scholastic teaching about God, it was the affirmation that God cannot be a body. If all natural force resides in bodies, then any idea of an exercise of power on God's part and, resultantly, any assumption of divine action in the course of nature were *a priori* excluded. Thus, God was respectfully urged out of the natural world.

When one duly considers the far-reaching consequences that the reduction of forces and motion to conceptions of bodies and masses had upon an atheistic picture of nature, one can also imagine the potential significance that Faraday's introduction of field concepts into the description of natural processes would have for a theological interpretation. This statement does not mean that the demonstration of the efficacy of electric and magnetic fields could immediately be used as a model to conceive of God's efficacy in nature. But although field effects usually have their correlate in masses, Faraday had already entertained a vision of finally interpreting all bodily phenomena as manifestations of fields. A vision like that was close to Newton's own vision that the forces of natural movement are, in the end, not material, as they do not issue from bodies. Rather, Newton conceived of God's efficacy in the universe in analogy to how the human spirit moves the parts of the body.

Just as God's omnipresence is co-present to all things without falling prey to the relativistic paradoxes of simultaneity—since God's omnipresence is not dependent on the velocity of light—in a similar way, the field effects of divine omnipresence are not in need of being transmitted by waves.

An introduction of the field concept into theology is not, however, suggested primarily by the question of how to understand God's activity in nature; but it is suggested first by internal problems in the doctrine of God. The designation of the divine being as "spirit" in the Gospel of John[9] has been interpreted since Origen in the sense that God is *nous*, a bodiless spiritual intellect. But this Platonizing interpretation does not correspond to the original meaning of the biblical word *pneuma*, nor to the corresponding Hebrew word *ruah*. In both cases, the root meaning is moved air, breath, even wind. In Greek thought, the word *pneuma*, which is usually translated by "spirit," was used in the sense of air in motion, as in breath or wind. This applies to the pre-Socratic philosophers, especially to Anaximenes, but also and particularly to the Stoics. According to Stoic doctrine, air, as the most subtle element, penetrates everything and holds the entire cosmos together through its particular "tension" (*tónos*). Early Christian theologians before the third century understood the New Testament identification of God as *pneuma* in similar ways. Now, one of the most renowned historians of science in our century, Max Jammer, who investigated the history of a number of key concepts of physics, considers the *pneuma* concepts of classical antiquity as predecessors of the field concepts of modern physics. Indeed, the intuitive idea of a field of power comes to paradigmatic expression in "a state of tension in the air."

Modern field concepts, however, differ in an important aspect from the conceptions of *pneuma* in classical antiquity: field effects do not require a material medium like air or "ether"—though in the nineteenth cen-

tury, an ether was still assumed. Field effects can pervade space without such a medium. The materialism of the Stoic doctrine of *pneuma* as air, however, in the sense of a most subtle element that penetrates everything else, formed the main reason for Origen's rejection of this conception in interpreting the Johannine characterization of God as spirit. The absurdities of a conception of God as body—as divisible and composed of parts—formed the negative reason for interpreting *pneuma* in terms of *nous*, and thus for conceiving of God in the image of a bodiless intellect. It is now evident that this conception does not correspond to the root meaning of *pneuma*. At this point, the field concept that replaces the *pneuma* doctrines of classical antiquity can become helpful in theology, because it allows the root meaning of *pneuma* to be distinguished from the concept of a material basis, ether, or medium. If the divine reality is conceived in terms of a field that manifests itself in the three "persons" of Father, Son and Holy Spirit, then justice is done to Origen's objections against any conception of God as body, while preserving the genuine meaning of *pneuma*.

Is such a theological use of the field concept a mere metaphor? At first glance, it may look like that. But one should not overlook that the fundamental requirement has been met for the application of the concept of field to theology, namely, the relationship to time and space—though in the sense of what has been said about the undivided infinite space of divine immensity, presupposed in all geometrical description of space, and about the undivided unity of time in God's eternity as the condition of all temporal sequence. The interpretation of the pneumatic particularity of God's being as field can be accounted for by relating it to the undivided wholeness of time and space prior to all geometrical description. By the same reason, it is distinguished from the field concepts of physics, but would function as a condition of those by analogy to what had to be said concerning space and time. The field of divine omnipotence, then, does not compete with concrete physical fields, but its activity works through all the natural forces without being exhausted by them. Just as God's omnipresence is co-present to all things without falling prey to the relativistic paradoxes of simultaneity—since God's omnipresence is not dependent on the velocity of light—in a similar way, the field effects of divine omnipresence are not in need of being transmitted by waves. The concept of waves, though important in the field notions of classical physics and especially as a basis for quantitative descriptions of field effects, may not be constitutive of the field concept as such, even though that concept would be empty without being related to time and space. If the concept of field in the strict sense can be conceived of without the idea of expanding through waves, then types of non-local, instantaneous communication between physical phenomena can also be conceived of in terms of field effects.

In the framework of this paper, it is not possible to apply what has been said thus far to a theological interpretation of the world of creatures, according to the sequence of their emergence in the history of the universe. A sketch of such an interpretation has been published in the context of my treatment of the doctrine of creation in the second volume of my *Systematic Theology*. In the dialogue between theology and science, however, it is even more important to reach agreement about the foundations of interpretations of such a type. This much may be said here: the key for perceiving the interconnection of eternity and time lies with the relevance of the future in understanding everything existing in time. It is through the future that eternity enters into time. Ever new contingent events proceed from the future, and, on the other hand, everything existing in time can expect from the future only the possible wholeness of its life. All things proceed towards the kingdom of God, whose sovereignty is already at work by entering from God's future into the presence of all

creatures. From the point of view of the creatures, this relationship gets reversed: the future becomes the direction of extrapolations from the present and from whatever is known from the past. That is also true in the history of the universe. Mythical interpretation of the world looks at the order of the universe as founded in its beginning. Even the biblical report of creation, though no longer a myth in its literal form, exemplifies this way of looking at the world. The image of the foundation of all creaturely forms in a first week of seven days is in a certain tension, however, to the perspective otherwise characteristic for the biblical understanding of reality, the perspective of ever new actions of God in history toward the future completion of creation. The idea of an order of creation, complete in the beginning and not significantly changed in subsequent time, made agreement between theologians and scientists difficult for a long period, especially during the struggle about the doctrine of evolution. Much more important, however, in view of a possible consonance between a theology of creation and natural science, is that the evolution of life occurs within an irreversible process, where again and again contingencies occur.

It is similar with the history of the universe. With regard to the origin and evolution of life, as well as in the field of cosmology, the ideological barriers between the scientific description of the world and the interpretation of the same world in Christian theology broke down. One would be asking too much if scientific cosmology were expected to produce a demonstration of the existence of God right away, as Pope Pius XII believed at the time of the first enthusiasm about the present standard model of the expanding universe. It is sufficient that theological interpretation of the history of the universe in terms of creation can be developed in consonance with scientific data and procedures. To this end, it is necessary that the theological doctrine of creation remain able to learn, not in the sense of adapting itself apologetically to every change of the scientific description of nature, but in the sense that theology remains vigorous enough to keep developing, from its own resources, new interpretations that try to do justice to a changing state of experiential knowledge of our world, in order to integrate it into the Christian understanding of the cosmos as being created by the God of the Bible.

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Endnotes:

1. Barth, III/1.
2. Gen. 8:22.
3. Clarke.
4. Kant, A 24f.
5. Ibid., A 31.
6. Plotinus, III.7.11.
7. "*Interminabilis vitae tota simul et perfecto possessio.*" Boethius, V.6.4.
8. Kant, A123.
9. John 4:24.

Wolfhart Pannenberg is Professor of Systematic Theology on the Protestant Theological Faculty at the University of Munich, and one of the foremost theologians of the twentieth century. In addition to his three-volume Systematic Theology *(Eerdmans, 1991-98), his other recent books include* Toward a Theology of Nature: Essays on Science and Faith *(Westminster/John Knox, 1993),* Metaphysics and the Idea of God *(Eerdmans, 1990), and* Christianity in a Secularized World *(Crossroads, 1989).*

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Cog and the Creativity of God

Peter Heltzel

The construction of a humanoid robot may be within reach. The science of artificial intelligence (AI) offers new understandings to contemporary Christian theology. First of all, the emerging field of embodied intelligence discloses the wholeness of the human being, correcting the tendency in Christian theology toward an anthropological dualism of body and soul. Secondly, artificial intelligence offers fresh understandings of the human mind, with implications for how human creativity reflects the creativity of God.

Can you imagine having a witty conversation with your own personal robot, similar in construction to C3PO from the film *Star Wars*, while he takes care of your laundry, dishes and waste disposal? By constructing "smart" machines and robots like C3PO, the artificial intelligence community hopes to improve the quality of human life. For example, the construction of a humanoid robot named Cog is currently underway at the Artificial Intelligence Laboratory at MIT. When the possibility of "artificial humanity" is considered, it seems that "natural humanity" has reached a new height of creative power.[1] What is the source of the human creativity that makes the construction of a robot possible? Is it simply evolutionary development, or does human creativity have its source in something that transcends human life? What kind of deity, if any, is implied in the creation of artificial intelligence?

Artificial intelligence (AI) sheds significant light on contemporary Christian theology.[2] This programmatic essay asserts three primary hypotheses. First, the attribute of human creativity is clearly illustrated in AI's attempt to construct a humanoid robot. Secondly, the creativity expressed in AI points to a creative transcendent being. The creative actions of the God of Christianity will be employed as a case study to put forward one explanation for the existence of human creativity. Thirdly, AI, like all human creations, is an example of humans being "created co-creators" with God; as such, it can be used for good or evil.

Artificial intelligence is a scientific discipline that studies all facets of the human mind. It culminates in the construction of useful artifacts based on human intelligence. Launched at a 1956 conference at Dartmouth College, conference as a systematic research program, AI is directed toward getting computers and robots to be "smart" and do "smart" things to assist humans in daily and vocational tasks. AI also employs computers and robots to simulate activities of human beings, so that the understanding of how humans work can be deepened.[3] AI is becoming increasingly a reflexive science, constantly benefiting from a dialectic between computers and the human mind.[4] This symbiosis allows for immense creativity through the development of many different engineering applications, including robotics, vision systems, language systems, and circuit design technology.

Cog, a humanoid robot

A major advance in the creative human spirit is occurring at the MIT AI Lab in its current attempt to construct an artificial human, something like the fictitious Lt. Commander Data of the television series, "Star Trek: The Next Generation." The construction of such a robot, named Cog, testifies to the remarkable creativity of AI. Isaac Asimov's vision in his mid-century novel, *I, Robot*, about a positronic android brain with humanlike consciousness, is slowly becoming a reality. Margaret Boden argues that developments like the construction of Cog have increased the sense of wonder among scientists today, wonder over the possibility of representation, meaning and mind.[6] One reason for the "wonder factor" within AI is the fact that the human mind-and-body is a mysterious and complex frontier. In visual art, drawing and painting the human figure is the most difficult creative challenge; likewise, in AI, building a humanoid robot is a formidable task. Although only the upper torso is complete on this fabricated human, Cog will be fully operational soon.

The justification for Cog comes out of a new trend in AI toward embodied intelligence (*contra* Dreyfus),[6] challenging the traditional symbolic approach, which asserts that intelligence is ultimately abstract, formal symbol manipulation that is independent of the medium in which the symbols are embodied.[7] Rodney Brooks, on the other hand, sees humanlike embodiments as critical to the development of humanlike intelligence. Embodied intelligence is a point of contact in the dialogue between AI and Christian theology, which affirms the psychosomatic unity of the human person.[8] The central premise behind embodied intelligence is that human consciousness is human because it is formed in a human, physical body. Although humanoid robots are not human, since they are not complex biological systems with a brain and central nervous system, James Sennett hypothesizes that they can still be thought of as persons (though not human persons) when they exhibit "self-consciousness" (e.g., in the ability to assess their own states).[9]

During the past decade, AI has run into several roadblocks in constructing a humanoid robot. For example, in terms of the development of mind, emotions remain an enigma. In contrast to Cartesian rationalism, recent neurological evidence suggests that emotions are not a luxury, but rather that they are essential for rational decision making.[10] Many studies are currently underway in cognitive robotics that attempt to model human emotion, further expressing creativity in the lab.[11] Every step of the way, teams of AI engineers must be creative as they integrate new systems and abilities into Cog. The creative problem solving and sense of wonder in AI research is present in other research fields, but embodied AI's goal of building a humanlike robot, from the inside out, is a unique challenge. Where does this creativity point?

Analogy and the image of God

Jewish and Christian theologians are especially interested in AI's attempt to build a humanoid robot because of their belief that humanity is created in the image of God (*imago Dei*).[12] The concept of *imago Dei* claims analogically that in some sense humanity "images" God. Analogies show similarity *in* difference. There is a fundamental difference between humans (and humanoid robots) and God—namely, the difference between created and uncreated reality, the material and the immaterial. Medieval theologian Thomas Aquinas wrote, "No term can be used of God in quite the same sense (*univoce*) as it is of other things."[13] Although analogies are limited, they can deepen the understanding of God.

Analogy is also a central form of reasoning within science, including AI. The central thesis of AI—that human mental activities are similar to the activities of a computer—is based on analogy. Instead of seeing humans as made in the image of God, humans are viewed as machines. Such rea-

soning is creatively employed by AI engineers daily as they try to build a robot analogous to humans. The ultimate success of AI's analogical approach depends on the adequacy of a mechanistic and functionalistic explanation of humanity.[14] Daniel Dennet has become one of the chief proponents of the functionalist view of human life. In *Consciousness Explained*, Dennet argues that human consciousness can be explained comprehensively and decisively in purely material terms.

Roger Penrose counters that human consciousness is beyond the algorithms of computational science. When human beings are said to be self-conscious, it means that there is such a thing as being human: human beings have subjectivity. The subjectivity of the human person is a starting point for many modern theologians, including Wolfhart Pannenberg.[15] This theological approach is typically called "theological anthropology." It attempts to discover the theological significance of human self-consciousness as described by the natural and human sciences, which today includes AI. Creativity is one aspect of human consciousness and intelligence.

There is a significant sense in which the act of humans building humanoid robots mirrors God's creation of and continued interaction with humanity.

The creativity of God is a sufficient explanation of the creativity of the human mind, but not a necessary one. There are alternative and competing theories that are equally viable, but these do not have to exclude a theist option. If Penrose is right in saying that a computational explanation of consciousness is inadequate, maybe another approach will succeed in explaining and constructing humanlike consciousness. For example, the embodied approach employed in the Cog project, may eventually succeed in producing autonomous, self-conscious intelligence. If this end is accomplished, many naturalists will claim that this human attainment proves God's nonexistence. However, this would be only the second time that autonomous intelligence was created, the first being the creation of human intelligence.

When one considers all of the intellectual capital—both in theory and infrastructure—that has gone into developing science and technology throughout human history in order to place AI on the platform, possibly to create autonomous robots, it is an unlikely conclusion that this is an accident of cultural evolution. A great deal of time, planning, and cumulative collective human intelligence would have gone into the successful creation of an autonomous humanoid robot. Why not conclude that this deliberate, laborious process points to an even greater preexistent intelligence? This essay will proceed by correlating the human creation of robots with the divine creation of the world.

The analogical argument

The source of human creativity is coherently explained by the paradigmatic biblical creation accounts. The creativity demonstrated in AI reflects the creativity of God.[16] Creativity, which is a central part of human personhood, finds its source within God, the Creator of the universe, who continues creative activity throughout human history. The similarity in the analogy is that humans building robots mirror God's creation of mankind. One difference is that humans were originally created perfect (*imago Dei*), whereas cognitive robots will never be perfect because of human fallenness (*imago humanitatis*). Therefore, robots made in the human image inherit both its beauty and its ugliness. Because human existence is divided between good and evil, AI (and all human endeavors) have the potential for good and evil.

The second hypothesis of this essay, that the creativity expressed in AI points to a creative transcendent being, is questioned by some scientists. For example, Karl Popper contends that theories should be, in principle, falsifiable.[17] Since the concept of the creativity of God implies the existence of a deity, which is an unfalsifiable belief, Popper would claim the second hypothesis of this essay to be inadequate. However, Popper's positivist epistemology has now been questioned by many post-foundationalist philosophers, including Kuhn and Lakatos. It is the methodological work of Imre Lakatos (via Nancey Murphy) which is especially helpful in getting around this roadblock to religious discourse.[18]

In contrast to Popper's concern with the falsifiability of theories, Lakatos emphasizes commitment to a certain "research program." He urges that attention be directed not to individual hypotheses and theoretical networks at any one point in time, but to the development of research programs over a span of time, such as the Newtonian program to treat the universe as a mechanical system. The "hard core" of a program (like Newton's laws) is exempt from falsification so that positive possibilities can be explored. Therefore, this essay will proceed with the triune God of Christianity as the "hard core," while exploring the possibility of the Christian God being the source of human creativity exhibited in AI. This "gamble on transcendence," as George Steiner describes it, suggests that all human creative efforts imply the existence of a God. It is the *imago Dei* that serves as the essential link between humanity and God in the biblical narratives.

In the Old Testament, the image of God is mentioned directly in only three passages (Genesis 1:26-27; 5:1-3; 9:5-6). This essay emphasizes creativity as one way humans reflect God. The idea of humanity's creativity being a reflection of God's own creativity has a long poetic heritage. For example, British Romantic poet, Samuel Taylor Coleridge, asserts in his *Biographia Literaria*, that it is in the act of human creation that the *imago Dei* is truly expressed.[20]

Source Analogy *(creator)*	***Target Analogy*** *(created)*
GOD	HUMANITY *(imago Dei)*
HUMANITY *(imago Dei)*	HUMANOID ROBOT *(imago humanitatis)*

Coleridge defined imagination as "the primary Power and prime Agent of all human Perception, and as a repetition in the finite mind of the eternal act of creation in the infinite I AM."[21] Coleridge asserts, intuitively, that human creativity points to a creative transcendent being.

Is this transcendent creativity an abstract principle or a personal God? Rejecting speculative metaphysics and focusing on human creativity, humanist theologian H. N. Wieman claims that God is "Creativity."[22] The notion of person implicit in the Christian doctrine of the Trinity (one essence and three persons: Father, Son and Holy Spirit) does not allow for a deity who is simply an abstract principle of creativity. The Christian understanding of the triune God brings together human creativity and divine creativity in the doctrine of *creatio continua*; since the initial creation of the world, God continually and creatively sustains it. There is a significant sense in which the act of humans building humanoid robots mirrors God's creation of and continued interaction with humanity. Furthermore, humans as cre-

ative agents have freedom to "co-create" with God, through making artifacts out of natural materials.

The creative God

Theologian Robert Neville argues that creation is the root doctrine of Christian theology and a paradigm for human creativity.[23] Creation means the work of God in bringing into being, without the use of any preexisting materials, everything that is. The biblical story affirms that God brought the whole world into existence, *ex nihilo*—out of nothing.[24] Although the initial creation was immediate, there has also been a mediate or derivative creation, God's subsequent work of developing and fashioning what was originally brought into existence. In Book 12 of his *Confessions*, Augustine describes the subsequent origination of new entities fashioned from the previously created material that the Bible calls "formless and void" (Gen 1:2).[25] From this invisible myriad of atoms, God continues, throughout the first chapter of Genesis, to fashion the universe by progressively bringing forth matter: God says, "Let the waters bring forth. . ." (vs 20), and "Let the earth bring forth. . ." (vs 24). Furthermore, the description of the forming of Adam specifies the use of some type of material—"dust from the ground" (2:7). According to Augustine's exegesis it may well be that what God did originally was merely to create from nothing, and then in subsequent creative activity, God fashioned everything from the atoms initially created. Therefore, the various species created at the later time would be just as much God's doing as was the origin of matter.

If God does at least part of the creative work through immanent means, the origination of the various later species through the laws of genetics—even recent hybrid varieties of roses, corn, cattle, and horses—is God's creative work. In these cases humans are often partners with God in producing what comes to be, "imaging forth" artifacts as God did in creation. Thus, from this perspective, God is involved in AI as engineers construct robotics out of various metals, circuits and chips. God's initial creation becomes a paradigm for the ongoing creative process in the world.

After sparse mention in the early twentieth century, the doctrine of creation has enjoyed a recent renaissance in Christian theology, related to contemporary environmental concerns. Earlier understandings of creation emphasized the initial act, and particularly the uniqueness of God's power to create *ex nihilo*, while human beings are always dependent on preexisting materials for their creative acts. More recent considerations of the doctrine of creation, however, have emphasized the continuing creativity of God, emphasizing the similarity between divine and human creativity through the recognition that God, as do people, creates by rearranging preexisting materials.

In these cases, humans are often partners with God in producing what comes to be, "imaging forth" artifacts as God did in creation. Thus, from this perspective, God is involved in AI as engineers construct robotics out of various metals, circuits and chips.

This renaissance in the doctrine of creation has been enriched by the contributions of theologians from a variety of perspectives.[26] The concept of *creatio continua* makes three primary affirmations: (1) creation is an ongoing process in which God is continuously active; (2) God is everywhere present, affecting the creation at every mo-

ment and at every level of complexity; (3) the future of creation is open-ended.[27] These affirmations show that God may be seen as one who accompanies the evolution of the cosmos, sustaining and influencing its development.[28] If God is continuing to create new forms and new possibilities, what is humanity's role in this continuing creation?

Co-creating in artificial intelligence: a concluding proposal

Human work, especially technological innovation, may be seen as partnership with God in the continuing work of creation. Some have suggested the term "co-creation" to describe this role for humans. Karl Barth was leery of this term because it implied an unsubstantiated equality with God that has been articulated by some AI researchers.[29] Philip Hefner's more nuanced version, "created co-creators," is more appropriate. Hefner writes, "the human being is God's created co-creator, whose purpose is the modifying and enabling of existing systems of nature so that they can participate in God's purposes."[30]

Through science, a greater comprehension is gained of the natural processes through which God creates. For example, cognitive robotics is helping with the understanding of the complex interaction of all the human systems that make for human consciousness. With a deeper understanding of these processes, human beings can participate in the ongoing creativity of God.[31] From this perspective, science and technology serve God's ongoing creative work.

When seen in this light, cognitive robotics is a new modality for divine agency, as are other forms of technology. This is not to take away from the high level of human creative intelligence demonstrated in projects like the construction of Cog. Rather, this Christian concept of God goes beyond both deism and naturalism. *Creatio continua* opens up the possibility that God continues to act creatively in sustaining the world.

The concept of created co-creators implies that human beings actively take part in God's ongoing creativity. Thus, they also have responsibility for their creations. Frightening images of Frankenstein and golem loom large in the cultural imagination of the West. AI can be applied for good or evil ends. Therefore, it is in the technological assessment of AI that a dialogue between science and religion can be helpful. AI challenges traditional Christian theologians to resist the neo-Luddite impulse and critically embrace the changing world. On the other hand, Christian theology challenges AI researchers to think profoundly about the nature, responsibility and purpose of humanity. Together, scientists and theologians can begin to discuss the plethora of pressing questions raised by this creative advance.[32]

Instead of subverting human creativity, the Christian concept of an active, personal, Creator God provides a compelling explanation for humanity's creative prowess. This dynamic view of the creative God as a spiritual explanation for the evolution of human creativity provides an alternative to Dennet's naturalistic explanation. Seen in this light, AI is a shadow box show of the continuing creativity of God.

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Endnotes:

1. The term "artificial humanity" is used by Rodney Brooks and others within the field of cognitive robotics (a subdiscipline within AI) to indicate the goal of constructing an autonomous humanoid robot.

2. The term "artificial intelligence" (AI) will be employed throughout this paper to denote both the scientific discipline, as well as the community of scientists and engineers who carry out research in this field.

3. Brooks and Stein.

4. Cf. Wiener, pp. 11ff.; cf. Stein.

5. Boden.

6. Brooks and Steels; Foerst (1998), pp. 99-102; cf. Dreyfus.

7. For an explanation of the symbolic approach see the discussion of "Good Old Fashioned AI (GOFAI)" in Haugeland.

8. The classical Christian affirmation of embodied humanity (*contra* gnosticism) is reinforced by the doctrines of the incarnation of Jesus Christ and the resurrection of the dead. Cf. Tracy for a modern treatment of embodiment .

9. Sennett, p. 197; cf. Lillegard.

10. Damasio; LeDoux; Picard.

11. Velasquez; Pfeifer.

12. See Foerst (1998).

13. Aquinas, 1.32, p. 143.

14. Foerst (1996), p. 685.

15. Pannenberg.

16. On the warrants of analogy in theological construction, see Tracy, pp. 405-445.

17. Popper.

18. Murphy.

19. Scholem, pp. 63, 64; Sayers.

20. Coleridge, part 13, 14.

21. Coleridge, 1, p. 199.

22. Wieman.

23. Neville.

24. Gen. 1:1; cf. John 1:1-3; Rev. 4:11; Romans 4:17; May.

25. Augustine, 2.12.1-17, pp. 289-328.

26. E.g., Whiteheadian process theologians (John Cobb and David Griffin), scientist-theologians (Arthur Peacocke and John Polkinghorne), and trinitarian theologians (Jurgen Moltmann and Thomas Torrance).

27. The openness of the future, the third point, is the most theologically debatable of the three affirmations of *creatio continua*. The future is open in terms of the creative potential of human beings; however, the future of the cosmos is certain from an eschatological standpoint. Limiting God's knowledge of the future is problematic for the traditional understanding of the omniscience of God. For a defense of God's omniscience, focusing on the issue of quantum indeterminacy, see Davis.

28. Peacocke; Polkinghorne.

29. Theologian Karl Barth argues that the primary continuing creative work of God is building the new creation, the Church. See Barth III/1.

30. Hefner, p. 212.

31. The idea that humans can co-create does not mean that all human creative activities are divinely inspired.

32. Pressing ethical and philosophical questions raised by AI remain for further discussing: e.g., How will these robots be used—for the benefit or destruction of humanity? Do robots have a soul? What moral and ethical properties do robots have? How will the existence of thinking machines that are smarter than humans affect human self-understanding? May the conversation continue!

Having received his M.Div. degree from Gordon-Conwell Theological Seminary in 1998, the Reverend Peter Heltzel is now a doctoral student in theology at Boston University. He is a published author in the science-and-religion discourse. An ordained minister in the Christian Church (Disciples of Christ), he serves Park Street Church in Boston, Massachusetts, as a minister to college students.

This essay, dedicated by the author "to three generations of Heltzel men: Robert Edgar, Samuel Bowen, and Robert Strader," was awarded a First Prize.

No Time for Time: Trans-temporal Creation of a Time-bound Realm

Troy Catterson

The radical contingency of all scientific laws is now recognized, owing to new vistas opened by research in Quantum Field Theory, a contingency that implies the dependence of the structural parameters and developmental trajectories of the universe upon the creative power of God. This essay delineates a specific model of atemporal causation, which elucidates the relationship between a time-bound universe and a God who is beyond time.

Classical theism engenders for itself an interesting and yet vexing conundrum: It posits a God that exists beyond time and the vicissitudes of change, and yet it is this God who must somehow 'act' to produce the whole spectacle full of sound and fury. The God who cannot change is the creator of all change. This is the problem of Aristotle's 'unmoved mover.'

Nonetheless, the modern theist who wants to take science and its methods seriously cannot take Aristotle's way out. God cannot play the role of the final cause of the cosmos, first of all, because this would constrain God's influence upon creation to a necessary outworking of God's mere subsistence—God had no choice but to create—and secondly, because science in its physical incarnation brooks no appeals to final causes.

From the perspective of general relativity, or even classical mechanics, the same problem appears in a different garb. Theists want to say that God is the creator of the entire spatiotemporal realm and its contents. But whatever could they mean by this locution? They could mean that God is the cause of the existence of the universe. But, this will not do. Within these theories, causality is always articulated in terms of chrono-geometric relatedness. That is to say, two entities or events are said to be causally related only if they can be placed on the same manifold. Since, by hypothesis, God is beyond this manifold, it would not make theoretical sense to speak of God as the 'cause' of anything within it, let alone the manifold itself. So classical scientific models of causality fail to be models of divine creativity. Instead, they serve to set in sharp relief the current lack of a theological model that satisfies the sentence, "God is the creator of the world."

However, recent developments in Quantum Field Theory allow for a specific model of atemporal causation, which elucidates the relationship of a God who is beyond time to a time-bound world. These developments consist in the setting forth of various quantum models of cosmology. What is interesting about these models is the way in which they explicitly rely on the ontological efficacy of the mathematical formalism that underlies their construction. The emergence of such models seems to abet theists who espouse a logos-centered cosmogony, whereby God creates or determines the nature of reality by means of the defining structures of rational or linguistic form.[1] It provides them with a clear way of making sense of the sentence, "God creates the world through the power of God's word"; and it does so without submerging either the temporal or trans-temporal perspectives.

Of course, immediately pertinent is the question of how the construction of a coherent model of divine causality helps to learn anything about God. When one says that one has learned something concerning an object of inquiry, it usually means that one has come to know something about it. Mere consistency does not entail correspondence, and it is precisely this correspondence that is sought. In response, the question may be inverted: How, indeed, does one suppose to learn anything at all about the world without the mediation of some theoretical model?

Perhaps an example is in order. In trying to find out why a gas, released into one side of a sealed chamber, distributes itself evenly throughout the chamber, what is the first thing to do in order to begin answering this question? A causal mechanism is sought that explains this dispersion. But such a mechanism, by the nature of the case under consideration, would not involve observable entities. So the first thing is to formulate a model of a gas as an infinite ensemble of microscopic particles in constant motion and interaction with each other. Then, this model is utilized to construct a theory of the evolution of the gas to a state of equilibrium that pictures the outcome of this process as a consequence of the motions and collisions of the constituents of this ensemble.

It is only after the model is constructed and it has passed the tests of coherence and explanatory efficacy that one comes to the question of truth. Indeed, without the model the question cannot even get off the ground. One is left in a state of blissful bewilderment, musing over an apparent mystery of nature. The situation is the same in the case of learning about God's creative agency in and of the world. The development of a coherent model of atemporal causation sets the stage for an inquiry that would have been inconceivable without it—a sort of groping around blindly for a way in which to ask the question meaningfully. Now the subject of veracity can be broached.

Quantum cosmologies treat the universe and its evolution like the history of a subatomic particle and its change of state between any two points in phase space. In so doing they can ideally determine a unique state function for the universe. This function assigns a probability for the appearance of a particular classical spacetime, namely this one. It is significant that the mechanism of causation brought into play here is not physical in the vulgar or intuitive sense. Instead, the existence of the state function is relied upon. This mathematical function occupies the role of the determinative as well as the descriptive factor in an explanation. And since the occurrence of a particular spacetime is to be solved for, the notion of determination or causality, in this context, cannot be time-dependent; it must 'transcend' the manifold it seeks to specify.

So classical scientific models of causality fail to be models of divine creativity. Instead, they serve to set in sharp relief the current lack of a theological model that satisfies the sentence, "God is the creator of the world."

John Wheeler's model of quantum origination, in my opinion, combines the theoretical insights of earlier theories utilizing path integrals.[2] However, before delving into the details of this formulation, it is necessary to achieve a rudimentary understanding of the path integral approach to quantum dynamics. When determining the classical path of a particle between two points, the principle of least action is used. In a

one-dimensional illustration, where a particle moves from a point **A** at an initial time t_a to a final point **B** at t_b. By fixing the endpoints, a path between **A** and **B** is specified that satisfies two requirements: 1) the time required by the particle to travel from **A** to **B** along this path is less than that required by any alternative path arbitrarily close to the postulated path; and 2) the difference between the total energy of the particle and its potential energy is a minimum along all points of the path. This is called the "path of least action," and the quantity that gives this path is called the Hamiltonian. Now this interest in the Hamiltonian as the value of the extremum path between point **A** and point **B** carries over completely into the quantum formulation—except, instead of the Hamiltonian providing the actual path of the quantum particle, it becomes the value on which the determination of the probability amplitude of any possible path between the two points is uniquely dependent.

In the path integral approach to calculating the amplitude, the final amplitude is the summation of all possible paths whose amplitudes constructively or destructively interfere. The summation, however, is not strictly democratic. In fact the contribution of any particular path ***e*** is directly proportional to the Hamiltonian. Amplitudes that differ substantially from this value can be pictured as being completely, or at least nearly completely, out of phase with the classical path. Hence, destructive interference cancels out its contribution to the final probability distribution. This, of course, portends a positive contribution of the values of those paths that are most nearly in line with the classical path, which implies a stabilization of the amplitude peak around the vicinity of the classical path. But in order to achieve this result, which removes intractable infinities, the time variable must be rotated to imaginary values in the complex plane. This transforms the metric from a Lorentzian to a Euclidean path integral.[3]

Several alterations need to be made in this account, before it can be generalized to determine a state function for the history the universe. First of all, the usual state function is time-dependent. That is to say, the evolution of state for a quantum particle is formulated as a function of a background space and time. Since the universal state function is supposed to calculate a probability amplitude associated with the obtaining of spacetime itself, the function has to be reformulated in terms of certain internal parameters that will serve analogous roles. The most common way to go about this is the utilization of an infinite dimension vector space called 'superspace.' Roughly speaking, this is a way to geometrize intuitions concerning certain complex physical quantities—quantities that are functions of multiple parameters or conditions—by shrinking the coordinate systems through which they are represented to individual points on superspace. By doing this, their relations with other quantities can be depicted geometrically.

Implicit within the Hilbert derivation of general relativity are the basic principles that make up superspace. Add to this a quantum formulation for the determination of the action integral; only, instead of dealing with the paths of individual particles, the wave function is utilized to determine a sequence of spacelike surfaces of simultaneity in superspace, or a series of three dimensional surfaces between two bounded hypersurfaces. This can be accomplished because the infinite dimensionality of superspace allows each 3-geometry to be treated like a point. Using coordinate-free geometrical parameters, state functions for each pointlike 3-geometry are formulated that depend on what is fixed at the two endpoints:

$$\Phi = \Phi({}^{3}\mathbf{g})$$

In the quantum analysis, however, these state functions constitute probability amplitudes. Hence, the 3-geometries with appreciable probability amplitudes are far more

numerous than can be accommodated in any one integration between the two boundary points. This can be dealt with by treating any possible sequence of 3-geometries like a possible 'path' between two endpoints. The amplitude to go from one boundary point to the other is the sum of the amplitudes for each interfering alternative path:

$$\Psi = \sum_{\text{over all paths from a to b}} \Psi({}^{(3)}g),$$

where **Y** is a classical spacetime path between two 3-geometries **a** and **b**.

The amplitude for a given path has a phase proportional to the action, **S/h/2π**, where the value of **S** is given by the extremal value of the action integral. Now, since the extremal is assumed to be the path of classical action, the derivation of the classical spacetime is permitted to within arbitrary limits. In such a scenario, the action is very large compared to **h**. Therefore, neighboring paths have different actions which, because of the smallness of **h**, have very different phases. As a result, their contributions cancel each other out. Only in the vicinity of the classical path, where the action changes little when the path varies, will neighboring paths contribute in the same phase and constructively interfere, thus magnifying the amplitude of the classical trajectory.

However, there is a price to be paid for this type of fixing of successive 3-geometries. In doing this, the notion of a rate of change from one state to another must be discarded. In other words, the 3-geometry alone on an initial spacelike hypersurface may be determined to within arbitrarily narrow limits. But the reciprocal uncertainty in the rate of change will then be directly proportional to the degree of specificity attached to the 3-geometry. Therefore, it would appear as if the superspace derivation of a state function for the universe allows only limited validity to be attached to the notion of time. This limited validity does not imply the illusory nature of time. Rather, time must be redefined in such a way that two perspectives become equally necessary in any delineation of the nature of temporal process. Here is where the notion of an internal time coordinate comes in handy: the notion of a change of state or spatial configuration is used to interpret directly what is meant by 'time coordinate' in the first place. In order to do this, a sequence of different state configurations must be selected that are asymmetrically and linearly ordered, thus mirroring the ordering of the time coordinate. Since what is desired is to specify a classical spacetime with a positive matter/energy density—i.e., a universe like this one with a Robertson-Walker metric—the scale factor or the volume of the universe can serve this purpose rather well. To see how this works, picture a particle at point **A** at time **1**. In order to express the fact that this particle changed position over a specific interval of time, one must merely specify the change of position at a different volume of the background space. Specifying anything over and above this would be redundant.

If God extrinsically determines the character of every moment by means of some trans-temporal mode of action, and if these modes of action ensure the exact determination of everything that occurs at these space-like slices, then nothing in the spatiotemporal matrix is self-determined. There is no freedom or contingency in any concrete sense.

This allows a view of time from two different, and yet compatible, perspectives: from the perspective of the whole, and from the perspective of any particular member of

the temporal series. Of course, in fixing the whole of the sequence—say, by means of solving for the state function of this spacetime—there is neither before nor after. The determination of the entire metric takes place outside of the temporal sequence, and yet is intimately related to every point within the sequence. So although the determination is not temporally related to any point in the sequence, it is, nonetheless, causally or constitutively related. Now, why does this not do away with the notion of before and after? Precisely because the internal relatedness of each member in the series is just as real or fundamental as that of any other member. The fact that what is determined is a linear asymmetrical ordering guarantees this.

For those who hold that time is an open flow, indeterminate as to the fixing of future possibilities, this account cannot do justice to what intuition wants to say about time. To them, this openness to the future and its possibilities is the necessary element in any satisfactory account of contingency and, hence, freedom. So, it makes sense to ask how the fixity of all temporal moments can allow for contingency, and, thus, open the door for human freedom. There are two answers to this question, one logical, and the other culled from the treasuries of the quantum theory of origination, presently being formulated. First of all, logical contingency does not depend on time. Consider a being that exists eternally, that is, at all points in time. Does the being's eternal existence imply that it exists necessarily? Certainly not! One cannot posit the being's existence at some point in time and then go about denying its existence at some other point in time. But a possible world can be constructed where it is true that this being exists at no point in time. There is no inconsistency here—or if there is, it cannot result from the mere fact of the being's eternality. In other words, an eternal being can exist as a mere matter of fact. But then, contingency does not depend on being in time; something can be eternally fixed without being necessary.

Nevertheless, admitting this does not provide extrication from the original conundrum. If God extrinsically determines the character of every moment by means of some trans-temporal mode of action, and if these modes of action ensure the exact determination of everything that occurs at these spacelike slices, then nothing in the spatiotemporal matrix is self-determined. There is no freedom or contingency in any concrete sense.

However, quantum theories of origination do not ensure the actuality of anything, even in their ideal form. They only provide a probability for the obtaining of a particular spacetime. So, the problem has been shifted a bit. Now the question becomes: How can quantum laws of determination be taken as God's modes of creative action, when they seem to render God powerless to determine the outcome of anything? In view of this, it really seems as if God does "throw dice.' My contention is that the fault is not in the theory, but in ourselves—that is, in the interpretation of the notion of probability in this global context. In normal scientific contexts, assigning a probability to the occurrence of a certain event may mean one of several things. It may mean to measure the subjective degree of confidence

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as to the certainty of a particular outcome. But this interpretation of probability seems to imply that, in fact, the outcome is deterministic, contrary to the results of the Aspect experiments, which seem to make quantum probabilities an objective feature of the physical situation.[4]

A second way to interpret probability statements, and by far the most popular among physicists, is to take them as a measure of the frequency of the occurrence of a particular phenomenon. So in assigning a tossed coin a 0.5 probability of landing on heads, we really mean to say that if tossed ten times, it will land on heads five times. It is obvious that this notion of probability is time dependent. Thus, it cannot function as a model for the probability of a singular occurrence, and, *a forteriori*, it makes no sense in the atemporal case. The universe and its obtaining, by hypothesis, is not an occurrence; it cannot happen a certain number of times.

A third way is the statistical interpretation, where there is an ensemble of actual worlds, a certain number of which are instances of classical spacetimes, like our own. But there cannot be any uncertainty in the obtaining of this particular spacetime, since, by hypothesis, every possible world is already actual. Moreover, there is a problem with interpreting the path integral approach in this manner, as different worlds would need to be associated with interfering paths. If all of these paths are actual, the confluence of contradictory actualities would have to be postulated. Even the spacetime paths that differ only slightly and, hence, constructively interfere would still be incompatible in the details. Thus, either they could not interfere at all, or else those that do interact would have to be completely identical. Nor does interpreting probabilities as innate propensities help here, since it is not at all clear what would be meant by a tendency, apart from some measure of relative frequency.

I believe that the only way to render coherent the notion of a numerical probability within the context of atemporal origination is to interpret probability as relative informational specificity. It is already clear that the quantum evolution of a particle is completely compatible with intervals of completely deterministic evolution.[5] In other words, the quantum system can be prepared in such a manner as to have a concrete eigenvalue apart from any measurement of the system with respect to that quality. It is also the case that at the same time the particle can be in a state of coherence with respect to other eigenvalues. That is to say, it is consistent to view the system as a whole as embodying only a partial collapse of its wave function. In the same manner, one can speak of the path integral as God's way of canceling out possibilities by means of creative informing. For example, fixing the boundaries ensures that an infinity of otherwise-possible alternative universes do not become actual. The Euclidean rotation to the complex plane guarantees destructive interference among paths of completely different phases, and hence functions at an even greater level of specificity.

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The upshot is this: specificity of information cancels out possibilities, thereby engendering greater and greater degrees of actuality. In many ways this formulation captures what is meant by a state of affairs being actual. Consider the case where I am building a house. Once I have laid the foundation, it will be *actually* the case that my

house occupies a certain position on the block. Thus, the objective embodiment of a specific set of information cancels out any other possible location, and, in so doing, produces a concrete actuality. Of course, the house is not completely determined by the laying of the foundation. Degrees of actuality are measured by differing levels of abstraction. A general fact concerning an individual's existence does not determine the specific identity of the individual, and the determination of the specific identity of the individual in question does not decide the precise state that this individual exists in. Complete actuality is obtained only when all possibilities with respect to every facet of an entity's being are excluded, with the exception of one. Thus, the act of creation is equivalent to the stipulation of new patterns of information through God's intentional orchestration of God's own actuality. This is what is meant by God's creative decree.

The uniquely ontological and efficacious status of the formalism in quantum theories of origination was noted earlier. Hence, the intuitive dichotomy between physical matter and conceptual information or structure phases out at this level of discourse. There is no problem with talking about God creating the world by means of canceling out possibilities through God's aboriginal actuality. Furthermore, the quantum picture of origination allows this God the ability to leave the universe open to a certain extent. God specifies the parameters of the world's development in such a way as to have these parameters converge on a certain level of actuality, but this actuality is never so complete that it excludes the possibility of certain segments of the universe developing through self-specification. Thus, to hearken back to the house-building analogy, God as the master builder has the prerogative to hire out subcontractors who contribute to the erection of the finished product, called creation. There may be no "time" for time. But there certainly is a "place" for it.

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Endnotes:

1. See, for example, Peacocke, Polkinghorne.

2. Wheeler; Hartle and Hawking; Vilenkin.

3. See Feynman and Hibbs.

4. See Clauser and Shimony.

5. Isham , p. 86.

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Theory of Evolution and Faith in Creation
On the History of a Tense Relationship

Karl Schmitz-Moormann

This overview of the history of the idea of evolution includes the work of many European scholars often omitted from such accounts, particularly in the United States. It provides a case study in the origin of cultural tensions, owing to the attempts of some scientists and theologians, without sufficient interdisciplinary understanding, to undermine public confidence in each other's proper authority.

In the ongoing fight concerning the concept of evolution as a description of the reality of the universe, a large number of misunderstandings remain as to what should be considered a part of evolution and what is just part of a special theory of evolution. Before turning to the history of the concept of evolution, it seems necessary, at least to me, to clarify that this concept is not necessarily linked with a definite theory of evolution. Evolution in its general sense is neither Lamarckian nor Darwinian (explanations below); rather, it is only a descriptive term stating that everything within the universe has come forth through a process of becoming. Becoming in this context designates not simply the process known in biology as ontogenesis: the transformation of the highly densified information contained in a zygote into a living being of the same kind, a process that does not produce anything really new. Evolution, on the contrary, means exactly this: the appearance of new realities that did not exist before a particular point in time, through a process of becoming. The concept of evolution in its most general meaning thus states that the more comes forth from the less. This applies not only to the history of becoming from the protozoa to *Homo sapiens*,[1] but to the history of science and knowing, as well. The history of the idea of evolution is itself a good example of evolution.

The development of the idea of evolution is linked with the history of the conception of becoming. In striving for continuity, for stability, for security, for eternity—as it was expressed in very early funeral rites—human beings resented the idea that becoming should be of fundamental importance. The Eastern philosophers solved the "problem" of becoming by ascribing futility to all the outcomes of this process, declaring it to be Maya, just appearance. Only the return to the "eternal one," the divine whole or nirvana, which absorbs all individuality, is necessary for a meaningful existence. Falling into the world of Maya and re-ascending to the true world of the "eternal one" are the two aspects of a cyclic process, in which becoming is, at best, of secondary importance. Similar cyclic visions were developed in Taoism, e.g., in the belief that all things "come from the originative process of Nature and return to the originative process of Nature."[2] Later on, the book of I Ching, which was written under Taoist influence, introduced the cyclic principle of *yin* and

yang, both produced by the Great Original One. With this background, it is understandable why modern Chinese thinking did not turn to Darwin and the idea of evolution. Their expository textbooks on the world of Western thought mention names like Spencer, Huxley, Kropotkin, Bergson and the process philosophers,[3] but not Darwin.

In the Occident, the idea of evolution is at least implicitly contained within the cosmologies of the pre-Socratics. Thales (6th-7th century B.C.E.) had everything evolve out of the water. Anaximander (6th century B.C.E.) taught that the lineage that started with initial slime and led finally to the human being, had to pass, for example, through the stage of fishes. Xenophanes (6th century B.C.E.) recognized the fossils to be the remains of a once-living, but different, flora and fauna. The idea of a kind of general evolution out of prefabricated parts was developed by Empedocles (5th century B.C.E.). In his view, most accidental structures were discarded because they were not viable; in other words, the viable ones were selected. The explanation of the appearance of living forms through chance and selection is not, in fact, a very modern theory.

When Parmenides (6th century B.C.E.), and in his footsteps Plato and Aristotle, made the idea of being the center of their metaphysics, this early start to thinking the world to be radically within the horizon of becoming was lost. To Aristotle—and with him the Middle Ages and modern times[4]—becoming was essentially only the reconstitution of a past state of matter. Becoming, in this worldview, is repetition—the reproduction of something that has already existed. Within such a vision, everything is contained in the beginnings, and anything really new cannot come into being. Certainly, there were other attempts to go beyond the philosophers' principle of being, and to understand becoming in its property to produce really new forms of being. The atomists, known through the didactic poem *De natura rerum* by Titus Lucretius Carus (99-55 B.C.E.), are the most prominent example. For Lucretius the human race originated in natural processes, first by pure chance and selection. Its evolution started with primitives living in caves, passed through a culture of hunters and gatherers, produced civilization that mastered metallurgy, and finally reached the high culture of the Roman Golden Age. Lucretius had only minor influence on the thinking of the following centuries, which were dominated by neo-Platonism, by the Stoa, and later on by Aristotelianism. But often the fact is overlooked that there was a Lucretius-renaissance at the beginning of modern times, which spread the ideas of the atomists, mostly through clandestine groups.[5]

Among the Arabs, Avicenna (980-1037 C.E.), whose influence on occidental thinking is well known, presented the idea that the human race had its origins in an earlier form of animal. In considering Avicenna's mystical interpretation of the universe, a definite theory of becoming should not be expected. Picking up Plotinic ideas, he thought in terms of the emanation of the multiple from the one and the return of the multiple to the one. The ideas of Avicenna are reminiscent as of Hindu cosmology, as well as of the speculations of Nicholas of Cusa or of Teilhard de Chardin, at least in consideration of the return of the multiple to the one.[6]

In the Christian world of the West, the biblical story of creation was taken to be an historical report on the appearance of the species. It is certainly not a mistake to suppose that this understanding of the text by the vast majority of thinking people was not very helpful in furthering the idea of evolution. The experience of Galilei, who tried with insufficient proof to impose the heliocentric cosmos, shows how difficult it is to think in a way other than that of the vast majority. As far as the cosmic time frame is concerned, scholars relied on the dates of the Bible. They calculated the movements of the stars, the planets, and the sun quite exactly for each day of this universe—though

they evidently missed the fact that the universe did not start on Day Zero, as calculated. As late as 1852, the Oxford University Press published a set of tables, indicating the times of sunrise and sundown, starting with the sundown of Day One, 24 April of the year 0 A.M.,[7] or 4005 B.C.E.

Given this very restricted time frame in the mind of most people of the time, it is surprising to find that Leonardo da Vinci (1452-1519), on the basis of his observations of Alpine marine fossils—which he recognized as such, started to reflect on the process of sedimentation, mineralization, and natural erosion. As a result of his speculations, he proposed a minimum age of 200,000 years for the earth, a proposition some people might have considered highly dangerous. As a brilliant observer he also noticed the similarity between apes and men[8] —two hundred years before Linnaeus and Lamarck.

The idea of a kind of general evolution out of prefabricated parts was developed by Empedocles. In his view, most accidental structures were discarded because they were not viable; in other words, the viable ones were selected. The explanation of the appearance of living forms through chance and selection is not, in fact, a very modern theory.

Giordano Bruno (1548?-1600), who was a very controversial man in his time, and who is today often celebrated as a "martyr of science," believed in the eternity and infinity of the universe (the influence of Lucretius). According to Bruno, the spiritually endowed matter within the universe deployed itself creatively in its becoming. It is questionable whether his ideas can be said to be evolutionary, since his vision was strictly cyclical. At any rate, the time was not yet ripe for such an idea, even among the most prominent scientists. This becomes evident when turning to Carl Linnaeus (1707-1778) who, in 1735 and 1766, published the first comprehensive classification of the flora and the fauna since Aristotle. He introduced the system of binomial classification, which allowed every living being to be classified according to its genus and species—the same classification system still in use, though somewhat refined. Human beings were classified by Linnaeus among the primates as *Homo sapiens*. This has been refined to *Homo sapiens sapiens* to differentiate today's humanity from earlier human forms.

In the nineteenth century, Linnaeus' classification became one of the principal arguments in favor of evolution, and it still is today. Linnaeus himself was absolutely alien to such an idea, convinced that his system described the species just as they sprang from the hand of God in the first days of creation.

A French contemporary of Linnaeus, Pierre Louis Moreau de Maupertuis (1698-1759), influenced by Lucretius, developed the idea of selection and chance changes, the same as chance mutations. Such chance changes might, through alteration in environmental and geographical conditions, explain anatomical changes in a species, if enough time were allowed. He employed probability calculus to reason his theory of heredity in an empirical study of albinism and polydactylism.[9] Neither in its method nor in its theory has modern neo-Darwinism reached better models of explanation than that of Maupertuis.

In his *Histoire naturelle*, Georges Louis Leclerc Comte de Buffon (1717-1788),[10] another contemporary of Linnaeus, explained that species do change and conse-

quently bring forth new species. According to his view, all species may have evolved from a single species existing in the distant past. He found support for this hypothesis in the parallelism of organs and the involution of organs. Buffon did not offer a theory of evolution—which in my opinion makes him superior to the neo-Darwinists—but this deficit was certainly not the reason for the condemnation of his doctrine by the theologians of the Sorbonne.

Buffon did not limit his ideas about evolution to the realm of living species. He linked the appearance of the planets with a solar event in which a big comet hit the liquid surface of the sun, flinging out into space a sort of matter-fog that contained the mass of the future planets. He constructed a history of the earth that is very close to present ideas in geological dimensions. Based on the fossil layers, whose specificity was clear to him, he distinguished seven epochs, each of which was measured in millions of years. This, for the theologians of his time, was an absolutely unacceptable idea; only recall the time frames mentioned above.

Johann Friedrich Blumenbach (1752-1840), while not explicitly a forerunner of an evolutionary understanding of reality, made an important contribution that prepared the ground for it. He employed comparative anatomy to elaborate the morphological differences of geographically separated human populations. At the young age of twenty-three, he published his thesis, which is the starting point of physical anthropology as the science of the natural human diversity.[11]

In England, the successful physician and botanist Erasmus Darwin (1731-1802) had formulated clearly the question of the origin of species and life. In his treatise, *Zoonomia: or the Laws of Organic Life* (1796) he proposed the idea that all life developed from one primordial filament existing on the surface of the earth—an evolution that had started many millions of years in the past and was not yet finished. Erasmus Darwin, like many of his romantic contemporaries, speculated on a future open for the evolution of some kind of superhuman being.

It is astonishing that practically all these names linked with the history of the idea of evolution—and I did not mention them all—are omitted from the textbooks that teach about this topic. Science has adopted a very ahistorical way of thinking: in its own short view of its past, it replaces historical truth by hagiographic stories. Most people have the impression that the notion of evolution did not really exist before Darwin. Perhaps Erasmus Darwin receives an occasional mention, but only because he was Charles Darwin's grandfather.

Science has adopted a very ahistorical way of thinking: in its own short view of its past, it replaces historical truth by hagiographic stories. Most people have the impression that the notion of evolution did not really exist before Darwin.

The other man mentioned is Jean Baptiste Pierre Antoine de Monet, Chevalier de Lamarck (1744-1829), the "pet hate" of the Darwinists. Without any doubt, he was the first to try to develop a viable theory of the biological evolution. He was educated for the office of clergy, as was Darwin; but after a short time in the army, he turned toward science, first to meteorology and then to botany and zoology. As a botanist he elaborated a new analytical system of classification.[12] Professor of zoology at the Jardin des Plantes in Paris, he introduced the differentiation between the in-

vertebrates and the vertebrates; and he distinguished the groups of Crustacea, Arachnida and Annelida.[13] This highly important work of his is rarely mentioned today.

Everybody, however, knows about the first modern theory of descent, which Lamarck developed in his *Philosophie zoologique*. The rather vulgarized description of this theory as the inheritance of acquired qualities makes it an easy target for Darwinists. Lamarck's doctrine is much more differentiated, in fact. It distinguished between what is known as function-Lamarckism (whereby an organ is developed by use and is lost by nonuse) and psycho-Lamarckism (whereby new qualities of existing organs may appear by a "need" for them). A real refutation of Lamarck's ideas has yet to be proposed, though Darwinists have a habit of citing the experiments by August Weismann. He experimented with cutting the tails off mice for many generations, and wondered that their progeny continued to be born with tails. These experiments fail to consider, however, the essential points of Lamarck's theory: cutting off the tails neither takes away their function nor does it create a "need." The question is still open.[14]

Nevertheless, Darwin had an easy mark in the theories of Lamarck, whose work he mentions only briefly. The old Anglo-Saxon/French rivalry in science was in favor of Darwin. (Newton *versus* Descartes is another example; Robert C. Gallo[15] *versus* Luc Montagnier[16] is a more recent one; yet another is Stanford *versus* CERN, over the confirmation of the Z-boson (Z^0). Besides that, even in his lifetime Lamarck was a whipped dog—and easy to continue to whip. His superior at the Jardin des Plantes, George Baron de Cuvier (1769-1832), made his life hell. He did not want to share the opinions of his competitor. The fact that Cuvier, from 1822 on, was also the supervisor of the Protestant theological faculties in France may indicate the sources of the resistance against the rather revolutionary ideas of Lamarck. Both Cuvier and Lamarck were fully aware of the fossil evidence and they did not have any essential disagreement in the zoological field.[17] Based on the fossil evidence, Cuvier developed the idea of consecutive "eons," each one ending in a catastrophe, the evidence for which is found in the fossil record. The recolonization of the earth by a new fauna could start in either of two ways: 1) the migration of surviving species from other regions unaffected by the catastrophe, or 2) by divine re-creation. Cuvier viewed the latter to be the more probable.

This interpretation shows Cuvier quite in line with the tradition of the physico-theologians, who tried to prove God the Creator from the evidence in complex anatomical structures, in the behavior of animals, and even in stones. The most prominent name in this field is William Paley, whose *Natural Theology* was rather a latecomer after the *Insecto-Theologia* by Friedrich Christian Lesser[18] and other continental authors. But in his time, Cuvier was referenced not only by other workers in science, but by the large majority of philosophers, as well.

Immanuel Kant, after having elaborated the reasons to accept the idea of evolution of living beings, had this to say about the hypothesis:

> ...a risky adventure of reason; and there might be only few, even among the most ingenious scientists, who have never have it cross their mind. For you cannot say it is senseless, as is the *generatio æquivoca*, wherewith we understand the production of an organized being through the mechanism of raw unorganized matter. It would still be *generatio univoca* in the most general meaning of this term, inasmuch as only something organic is produced out of another organic, even though among this kind of being something specifically different, *e.g.*, when certain aquatic animals become, by and by, amphibians; and, after some generations, out of these land animals arise.[19]

The idea of evolution has been expressed here in a general, but correct, manner. Reflecting further on it, Kant stated:

> *A priori*, within the judgment of pure reason, there is no contradiction. But experience does not show us an example of this; according to iexperience, all generation that we know about, is *generatio homonyma*, not only *univoca*, as contrary to the generation out of unorganized matter; it produces a product which is of the same kind as the generating being even in its organization; and *generatio heteronyma* is, as far as our experience of nature goes, to be found nowhere.[20]

A small step from this point would have been sufficient to reach a theologically acceptable idea of evolution. But it is obvious that Kant had very serious doubts about this possibility, as he expressed with the rhetorical question, "Are you in a position to say: Hand me matter, I will show you how to generate a caterpillar!?" [21]

In 1785, thirty years after he (anonymously) published *Allgemeine Naturgeschichte*, Kant was still more outspoken:

> The smallness of the degrees of difference among the species is (since the number of species is so high) a necessary consequence out of their number. Only a relationship among them—such that either one genus had sprung from another and all from a single original genus, or from one single generating mother's womb—would lead to ideas that are so monstrous that reason recoils from them.[22]

Kant fully subscribed to the idea of creation meaning the creation of each species individually, which presupposes the creation of at least one pair for each species. The question, "Why is it necessary that such a pair exists?" is answered by: "This alone makes an organized whole, even though not within a single, individual body." [23]

Thus, in refuting the idea of evolution Cuvier could appeal to philosophers of his time, who are still highly respected today, even among scientists. Hegel, who quoted many pages of Cuvier, and Lamarck, as well, in his *Enzyklopädie der Wissenschaften*, rejected any possibility of evolution:

> Nature is essentially mindful. What Nature forms is definite, limited, and enters existence as such. Even though the earth was in a state devoid of living being, with only chemical processes, etc., there is, nevertheless, once the lightning of life hits matter, immediately a definite, completely formed being, like Minerva jumping fully armed from Jupiter's head. The Mosaic story of creation is still doing it best, when it says naively: one day the plants came into existence, another day the animals, and another day humankind. Humankind did not originate in animalkind, nor animalkind in the plants; everything is completely what it is at its moment of creation.[24]

Hegel's view was anti-evolutionary:

> Nature is to be considered as a *system of steps*, each of which proceeds by necessity out of the other and is the next truth of that one out of which it results—but not in such a way that the one would originate *naturally* out of the other. [Metamorphosis applies only to the such a concept.]...It was a clumsy idea of older, and even newer, natural philosophy to consider continued formation and the passage of one natural form and sphere to a higher one, as an externally efficient production; which, inorder to make it *clearer*, was relocated backwards into the *darkness* of the past.... From such nebulous, basically sensual notions, especially the so-called "proceeding," *e.g.*, of plants and animals out of the water and the "proceeding" of the more developed animals out of the less developed ones, etc., from such notions intelligent consideration must abstain.[25]

This anti-evolutionary position was rather general among the leading philosophers and scientists of the first decades of the nineteenth century, and one might wonder how it became possible for Charles Darwin's opus, *On the Origin of Species*, to be immediately received by a large public.[26] Evidently, there must have been a change in the general opinion.

In 1843-46, Robert Chambers had published his *Vestiges of the Natural History of*

Creation[27] in England. In this work, he presented a deistic and vitalistic theory of adaptive organic transformism (evolution) and of cosmic development. The book is full of factual errors, pointed out early on by Hugh Miller and Adam Sedgwick, but this did not hinder the book's publication in numerous editions and translation into many languages. Darwin himself gave rather late recognition, in the sixth edition of his *Origin of Species*, to the fact that this book was of essential importance in preparing the ground for his work to be accepted:

> In my opinion it has done excellent service in this country in calling attention to the subject, in removing prejudice, and in thus preparing the ground for the reception of analogous views.[28]

But Chambers' book alone could not explain why Darwin's ideas were received within the philosophical and in the scientific world. It should be recognized that science had increasingly settled on a level of materialistic-mechanistic interpretation of reality. This interpretation became added in with a faith in the unlimited possibilities of science, which was spread largely by popularizers and authors. Enlightenment attitudes not only in France, but elsewhere as well, had an anti-ecclesiastic and especially anti-Catholic tendency. Many years before the French Revolution, *The Berlin Monthly*[29] was filled with polemics against Roman Catholics and their superstitions. The materialism of the French Encyclopedists, Baron d'Holbach chief among them, was widely spread among the intellectuals of the time; religion was accepted only as a means to domesticate the lower classes. In Germany, Feuerbach (1804-72) opened the way to an atheistic understanding of reality, and at least the popularizers among the scientists made these ideas their own.

There is no doubt that quite a large number of nineteenth-century natural scientists thought themselves charged to refute faith in God, since everything is to be explained scientifically. In a rather naive way, Jules Verne expressed this conviction when he had the protagonist of his *Journey to the Centre of the Earth* declare, "However great the miracles of Nature may be, they can always be explained by the laws of physics." This expression of scientistic materialism—as it would be called today—with its unshakable faith in science, which believed itself to be the heroic fighter against the irrational faith in God of Christians and of all other religions in general, were represented in Germany most evidently by Karl Vogt, Jakob Moleschott and Ludwig Büchner. They were not philosophers who, like Holbach, taught a speculative atheistic materialism, but men of science, of the laboratory.

Karl Vogt[30] (1817-1895) was a zoologist at the University of Giessen, which he had to leave in the context of the 1848 revolution. He withdrew to Geneva, where he worked mostly in the field of paleontology. He is known for his violent defense of a materialistically interpreted Darwinism. A year before Darwin published his magnum opus, Vogt had translated Robert Chambers' *Vestiges of the Natural History of Creation* into German. When Darwin's theory was published in 1859, Vogt started preaching it, because he considered this theory to be supportive of his materialism. In his *Vorlesungen über den Menschen* (*Lectures on Man*), a curious discrepancy is found between his calmly exposited scientific arguments and his controversy with the biblical texts that is totally ignorant of the historical-critical method. This new biblical scholarship, at least in the Protestant world, was already past its first steps. For Karl Vogt, Noah's ark was a barrier to scientific development, and it had to be surmounted. Concerning Cain, he asked where his wife had come from. And he wondered why the Roman Catholic Church in Paris did not like him! He is probably the only scientist who managed to end a serious work of scientific inquiry with a defiant wave of the fist against

yapping dogs (the clergy of Paris) and the words, "Let them bark till they can bark no more."[31]

This aggressive posture of the popularizers is by no means an exception among the representatives of nineteenth-century scientists. Thomas H. Huxley was celebrated as the great protagonist against Bishop Samuel Wilberforce by contemporary literature, and praised as St. George killing the dragon Samuel Church doctrine was described as immobile in its dogmatic state and as unable to adapt to progressing knowledge. Belief in God's absolute revelation was a blockage to the progress of knowledge—an insurmountable barrier. This combative attitude became most clearly exposed in John William Draper's *History of the Conflict between Religion and Science*, a book showing only black and white, and full of banalities. Most readers today would discard it quickly as nonsense. But in its time it was one of the most frequently read books, translated into many languages: French, German, Italian, Spanish, Polish, Russian, Portuguese and Serbian—and quite naturally it was put on the *Index librorum prohitorum* by the Roman Curia (4 September 1876). It displays the same kind of accusations against religion that are as old as Lucretius: that the history of the Church is marked by bloody suppression, that all knowledge is suppressed by the Church, and that only science can free humanity. Draper's faith in the liberating effect of knowledge brought forth by science, shows a strange collection of inventions beneficial to people, all due to science—and opposed to faith, especially Roman Catholicism. The following list, far from complete, may give an idea of Draper's argumentation: telescopes, balloons, diving bells, thermometer, barometer, schools, newspapers, hospitals, canals, sanitation, census reports, cotton gin, medicines, manures, photography, railways, sewing machines, rifles, and warships.[32] Evidently, in this context, faith in science is much more important than validity of arguments against Christian faith. What does photography prove against faith? To be honest, it must be said that most of the scientists of Draper's day considered his arguments to be nonsensical babble. But he evidently expressed what people of his time wanted to believe: namely, that science is the great human liberator that will free the race from all misery, in which the Church—and especially the Roman Catholic Church—wants it to languish.

Draper, in the name of science, fought the Roman Catholic Church relentlessly, and there was plenty of usable material in the texts of the Syllabus of Errors and the First Vatican Council to show the antiscientific stance of the Catholic Church. His picks up on such condemning statements as these:

> All truths of religions derive from the natural potency of human reason. It is the first parameter according to which man may and must all truths of any order.[33]

> Divine revelation is incomplete, and, because of this, is submitted to a constant progress, which must correspond to the progress of human reason.[34]

Strict rationalists were naturally provoked beyond bearable limits by such declarations. Feuerbach had already recognized religion as some kind of projection. Miracles could not be proven by experiments; they contradicted scientific insight. The *Syllabus* may certainly be called opposed to science. The antimaterialistic stance, as well, becomes evident as in the following anathema:

> Whoever is not ashamed to affirm that there is nothing besides matter, he be excluded.[35]

The doctrine of evolution in its most general form is condemned as a sort of pantheism:

> Whoever says that the physical as well as the spiritual finite things, or at least the spiritual ones, emanated out of the divine substance, or the divine essence, and by manifestation and evolution becomes everything or, even worse, that God is the universal or indefinite being that

> constitutes itself by determining the distinct universe of beings according to genera, species and individuals: he be excluded.[36]

The Roman Catholic Church clearly claimed the right to delimit the autonomy of human reason:

> Whoever says that human reason is independent in such a way, that God could not command belief, he be excluded.[37]

And it is easy to understand why critical scientists felt perplexed by such sentences as the following:

> Whoever says that human sciences must be handled with such autonomy that its assertions are to be held true and may not be disaffirmed by the church, even if they contradict the revealed doctrine, he be excluded.[38]

> Whoever says that it is possible that according to the progress of science one might be obliged to understand the propositions of faith defined by the Church sometimes differently from the meaning by which the Church understood and understands them, he be excluded.[39]

Certainly such assertions coming from the Church must be understood with relation to the attacks it was receiving, especially those coming from the popularizers like Draper and Vogt. Draper aired his ideas for the first time in Oxford in 1860 before the British Association, while the audience was waiting for Huxley and Wilberforce to start their well known debate. Vogt taught that human beings did not exercise free will and that all thought and action were just the reaction to preceding physical states or processes. Such denial of human responsibility provoked a necessary response from the moral theologians. It would be a mistake to read the Roman Catholic teachings as a reaction to the modern sciences of the nineteenth century. Rather, they have to be seen as reactions to the materialistic ideological usurpation of scientific knowledge, a usurpation that itself pretended to be scientific.

Vogt did not need Darwin's theory, even though he judged it to be very useful as a contribution for the defense of his ideas. Jakob Moleschott used similar means. He was born of a Dutch freethinker father, and beginning in 1847 he taught physiology in Heidelberg. He made the ideas of Feuerbach and D. F. Strauß[40] mostly his own. Moleschott's central scientific realization was linking the law of the conservation of matter, proposed by Lavoisier, with the law of the conservation of energy proposed by R. Mayer. From this linkage of matter with energy, he concluded that all processes of soul and mind are material-physiological in nature. In his *Lehre der Nahrungsmittel—Für das Volk*,[41] Molleschott stated, "No thought without phosphorus," which became a slogan for many decades. Feuerbach, who was one of his spiritual fathers, wrote the following ironic review, much to Molleschott's irritation:

> Man is what he eats [Der Mensch ist, was er ißt]... Formerly we heard: In the beginning was God. Today we hear: In the beginning was the belly... The old world made the spirit the father of matter, the new one makes matter the father of the spirit.[42]

But Feuerbach's harsh critique was powerless against the popularity of Moleschott.

Unlike Vogt, Moleschott was a rather sober man, who was no fighter for his ideas. In 1852, in his book, *Der Kreislauf des Lebens (The Cycle of Life)*, he proposed that people abandon the use of cemeteries in favor of cremation, because cremation would bring corpses back into the cycle of life as fertilizer, instead of removing them from it in tombs. This suggestion made Moleschott one of the most controversial figures among the German scientists. Harassed by the public, he had to go abroad—but only as far as Italy. In Italy there were a number of protests staged against Moleschott by Roman Catholic students—probably none of whom had ever read one of Moleschott's contro-

versial books. He concentrated on his scientific work in the second half of the nineteenth century. He died in 1893 in Rome, after the city was no longer under papal government. His name became a sort of slogan for a materialistic worldview, but he hardly bothered, in fact, to defend materialism during his time in Italy.

It was quite another matter with Ludwig Büchner (1824-99),[43] who fought all his life for his materialistic "Weltanschauung." In 1855, four years before Darwin's *Origin of Species*, he published his book, *Kraft und Stoff* (*Force and Matter*). By 1904, it had been reprinted twenty-one times, and it was translated into fifteen languages. Journals and reviews criticized the book as bungled, but it was a strong seller, nonetheless. The core of his materialistic thinking centered around the idea of a purposeless universe; the appearance of life and humankind were unplanned, chance events of nature. The Darwinian description of evolution was helpful to him in defending his materialistic worldview. It is matter who thinks, not the spirit. Human intellectual forces are just a secretion of matter—an epiphenomenon.

This book by Büchner might be considered to be *the* popular, vulgarizing presentation of the opposition between faith and science; it did not give a serious elaboration of the tension between faith and knowledge, but set them in opposition to one another in a combative posture. To Büchner, as to most of his readers, it was evident that force and matter were concepts that might be interchanged. Thus, it is meaningless to speak of "spiritual" forces. The process of *creatio ex nihilo*, as seen by Christian faith or by any other religion, was to be refuted, since matter is eternally conserved and cannot be augmented nor diminished. The old Lucreatian notions, with the help of the first law of thermodynamics, experienced a happy revival. Any limitation on space could not be imagined—as Lucretius already said; consequently, space must be infinite. All life resides in organic matter, out of combinations of cells that arose out of living matter.

It would be a misunderstanding to read the Roman Catholic teachings as a reaction to the modern sciences of the 19th century. Rather, they have to be seen as reactions to the materialistic ideological usurpation of scientific knowledge, a usurpation that itself pretended to be scientific.

In the end, this world will be destroyed, because the laws of thermodynamics are unrelenting.

> With the most absolute truth and with the greatest scientific accuracy can we say today: there is nothing miraculous in this world.[44]

In such a universe, devoid of goal and purpose, there is no room for any religion. The universe is the product of the blind, unchangeable necessity of the laws of matter. Priests, then, are either ambitious or they are charlatans; and all faithful people are fanatics. Only ignorant laymen could believe in a personal God Such conclusions were unavoidable for the educated person following the ideas of Büchner.

Such perspectives are not really great visions of the future. These days, when materialistic ideas are wide spread, the radical striving for happiness demonstrates in many ways the hopelessness and the futurelessness of modern humanity. A century and a half ago, Büchner had to realize that reading his books turned people to melancholy. They

complained about the hopelessness to which his books exposed them. He tried to console his readers with the thought that standing under the merciless law of nature begets feelings of humility, or of repose, out of which grow self-contentment and self-respect.

> Not as the humble and submissive slave of a supernatural master, nor as the helpless toy in the hands of heavenly powers, but as the proud and free son of Nature, understanding her laws and knowing how to tutor them to his own use, does the creature of modern civilization, the Freethinker, appear..., the incarnation of the mightiest effort of Nature.[45]

These are only a few examples of so-called scientific ideologies of a generally materialistic color. There is no need to examine the materialistic faith of Ernst Heinrich Haeckel, who tried eagerly to win members for his Monist Union,[46] through which he spread the Darwinist evolutionary doctrine. It was no longer science that was proclaimed, but a scientifically ensconced religion .

Thus, no clear-cut picture may be found, with honest scientists in the service of truth on one side, and on the other side, benighted ecclesiastic theologians, still thinking in the Dark Ages. Actually, up to the nineteenth century, there was little fighting between science and theology. The utterings of the churches against science are rather to be looked at as something like trench warfare: one keeps the enemy at a distance without really knowing much about it. This view may make those antiscientific statements more understandable from a human standpoint,. From a theological standpoint, though, they are more justified than the claim of the proponents of science—or at least of those who thought of themselves as the missionaries of a materialistic worldview, preaching that science would be able to explain the world completely, once all the material prerequisites of the material process were discovered.

The late nineteenth century was deeply impressed with these notions. Between the teaching of the Roman Catholic Church, at least, and science thinking in an evolutionary mode, a large gap had opened; and with the faith in the superiority of science, there was little doubt as to where truth was to be found. This general belief is most succinctly expressed by the answer of a fourteen-year-old Harrow schoolboy. When asked, "What did Darwin do?" he replied, "Darwin disproved the Bible."

It might appear that Rome and the Catholic Church only disapproved of the idea of evolution, following a theology in the style of "*Roma locuta, causa finita*" [Rome has spoken, the case is closed]. But no less a man than John Henry Newman stated: "I cannot imagine...why Darwinism should be considered inconsistent with Catholic doctrine."[47] He made it quite clear why he thought so:

> There is as much want of simplicity in the idea of distinct species as in that of the creation of trees in full growth, or rocks with fossils in them. I mean that it is strange that monkeys should be so like men, with no *historical* connection between them, as that there should be no course of facts by which fossil bones got into rocks. The one idea stands to the other as fluxions to differentials... I will either go the whole hog with Darwin, or, dispensing with time and history altogether, hold not only the theory of distinct species but also that of the creation of fossil-bearing rocks.[48]

When the English anatomist and biologist St. George Jackson Mivart converted to Catholicism and, therefore, had to leave Oxford University, he taught in London at St. Mary's Hospital Medical School and published *Lessons from Nature* in 1876. He accepted the notion of evolution but argued against Darwin's theory of mutation and selection. Instead, he proposed an innate plastic power of "individuation" that would explain the production of new species.[49] Huxley, as well as the Roman Catholic Church, turned against Mivart in his attempt to bridge the gap between religion and science. This Church looked with growing dis-

approval at his publications, and in 1892/93 they were put on the *Index*. When he published a few journal articles in January 1900, he was excommunicated by Herbert Cardinal Vaughan. Some years after Mivart's death, this judgment was nullified on the ground that he was mentally ill at the end of his life.

The ideas of Mivart were picked up by others. The Dominican, M. D. Leroy, put forward his version of them in his book *L'Evolution restreinte aux espèces organiques*. An American exposition followed, by J. A. Zahm in his book, *Dogma and Evolution*. In Belgium, Canon Henry de Dorlodot taught quite positively on evolution.[50] In France, Pierre Teilhard de Chardin started to write on evolution during World War I. It must be pointed out that, to date, Teilhard has presented the most comprehensive essay integrating the world, understood as evolutionary, into theology. His life, marked by his banishment from an academic career at the Catholic University of Paris and his exile from France, is well known.[51]

But these were only some isolated Roman Catholic avant-gardes, fighting for a positive understanding of evolution and of science in general. In a wider view, neither among the theologians nor among the scientists was there any great readiness to talk with one another. Theologians liked to use arguments from the realm of science, but quite often without any real understanding and mostly for apologetic purposes. A nice example is a professor of dogmatics named J. Bautz, who taught in Münster. He used the example of volcanos to demonstrate the existence of hell in the center of the earth,[52] an argument that exposed him to general ridicule and earned him the nickname "Höllenbautz." That being said, it should be acknowledged that some of the so-called scientific claims were no less ridiculous—for example, Haeckel's declaration, "We now know that the soul is the sum of the plasma movements in the ganglion cells." Only in Haeckel's case, nobody laughed.

The profound abyss between Christian believers and those believing in science was well illustrated by Dostoyevsky in his novel, *The Possessed*,[53] in the episode about a young lieutenant who had attacked his superior in a rage, biting him into the shoulder. This is the description of his settling into his rural quarters:

> [He had] thrown two icons out of the window and hacked one of them with a hatchet. On the shrine in his room he had placed the books of Vogt, Moleschott and Büchner and had lighted church candles before them.

In view of the harshness of the controversy, which to this day has not totally disappeared, some vestiges of hope for better relations sometimes appear among theologians as well as among scientists. It is somewhat astonishing that there never was a formal condemnation of the theory of evolution by the magisterium of the Roman Catholic Church. Vatican I made no explicit decision against the doctrine of evolution; it essentially just repeated the principle that there is no possibility of a contradiction between faith and science. The most respected theologians of that time were nevertheless convinced that they had to refute the idea that the human body and the human race had arisen through evolution, and they declared those who held such opinions to be heretics. Thus, it really is amazing that the efforts of Monsignor Benigni to have evolution condemned by the Roman Catholic Church as heresy in 1925 did not succeed—thanks to the opposition of Cardinals Ehrle, Mercier, Bourne and Maffi.[54] This did not deter Cardinal Ruffini and other theologians of the "integrist" camp—as they are known in retrospect—from defending, up into the 1950s, the opinion that the human body was created directly by God and did not arise through of evolution. The last defensive statement of any importance to this question was the encyclical, *Humani generis*,[55] which admitted the possibility that the human body may have arisen by evolution, but with the restriction that human beings must have had a

monogenetic origin, that is, an origin in a single pair of parents.

Today it might be stated that, at least within the Roman Catholic Church, there is no longer any resistance to the notion of evolution. With the publication of the writings of Pierre Teilhard de Chardin, which began upon his death in 1955, there was quite a stirring of interest and great discussion, most of it only inside the churches. Vatican II, and most especially the pastoral constitution, was influenced by his thought, even to the very choice of words, if we are to trust the commentary of Joseph Cardinal Ratzinger on *Gaudium et Spes* (the Second Vatican Council, 1962-65). It is evident that Teilhard's ideas have not, even to this day, been adequately received, neither in science nor in theology. Theologians like to quote him, especially to show that there is no incompatibility between Christian faith and evolutionary theory. But mostly they are contented just with this statement, without asking the hard questions about what kind of fundamental changes in theology will follow if this world is an evolving creation.

Thus, no clear-cut picture may be found, with honest scientists in the service of truth on one side, and on the other side, benighted ecclesiastic theologians, still thinking in the Dark Ages.

Today, the battle around evolution has practically ceased. But this does not mean that any fundamental changes in the presentation of the doctrine of creation have been made in the theological manuals; this does not differ essentially from that in the manuals of the last century. By having pushed the process of demythologization ever further (most often combined with a growing sociologization), theology and faith largely got rid of the difficulty with confronting the knowledge of science. Even more, transcendalization has opened up a region in which, by definition, no empirical proof is possible. Except among the fundamentalists in some regions of the United States and Australia, where they exercise some influence as "creationists," and except for the few dispersed integrists in the Roman Catholic world, no theologian today is seriously concerned about scientific theories such as the theory of evolution—though exceptions do make the rule.

The existence, side by side, of these two realms of knowledge—which consider one another as mutually irrelevant—is not without consequences. With science, the narrowing of the horizon of cognition to the empirical, experimentally provable—and/or to the mathematically expressible—has led to the incapacity of science to speak about the spiritual dimension with competence. This is clearly demonstrated by experimental psychology, for example, which is barely able to recognize the nuances of the spiritual. The innumerable theories of human psychology that keep appearing, and the schools linked with these theories, may be sufficient indications of this state of affairs.

It might be said that the controversy today is no longer maintained by strongly opposed positions on either side. Attempts to deliver a theory of science as a secure basis of the sciences have not succeeded with a really convincing proposition. The discussion has withdrawn to the question of true and false judgments, and this has given scientists a much clearer feeling for the preliminary nature of their knowledge and especially of their worldview—if they dare to try one. The claim to refute religion or faith is alien to most scientists of today, even though there might be a few grandchildren of the Haeckels and the Drapers around.

The fight is over, but there is no victor. The fighters lost interest in their fight without overcoming their opponents. The inter-

est of science in refuting theology, with few exceptions, no longer exists. Nor does theology feel itself menaced by science; theology generally considers science to be irrelevant—and therewith, the theory of evolution.

Looking at the present situation, the whole fight between theology and science appears rather superfluous. The idea of evolution was used, as Haeckel intended, as a weapon to destroy Christianity and all other religions. Unfortunately, this fight stopped theological thinking from seriously addressing the question of the importance of the process of evolution for the Christian faith. Even now, thinkers get stuck in an apologetic, defensive stance, which inhibits a positive integration of the evolutionary character of the universe into a theology of creation.

On the other hand, it must also be stated that the inability of the scientists to liberate themselves from their materialistic prejudices has trapped them in the rationally unacceptable theory of neo-Darwinism, which seems to be breaking up today—but only very slowly.

The question of whether, in the long run, theology can survive while continuing to ignore the results of science, especially evolution, has yet to be answered. This is a question that cannot be treated by giving an historical overview such as this. The answer will be found, rather, by starting from theologically given presuppositions, e.g., from the article of the creed, that this universe—which is explored by science—is God's creation.

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Endnotes:

1. Some philosopher or other worker in the field of human sciences might look with dismay at the idea that human knowledge itself is a part and continuation of the evolutionary process. But this is an evident fact inasmuch as the human being has never ceased to be a part of the evolutionary process. It is not a matter of nature on the one side, humanity on the other. The latter is a part of nature, and nature's process of becoming did not come to a standstill with the human being.

2. Chang, p. 204.

3. Ibid., pp. 743-5.

4. Exceptions like Whitehead and his school of process philosophers, or Teilhard de Chardin or Bergson confirm this statement rather than contradict it.

5. Cf. Giambattista Vico (1688-1744), for example, who belonged to one such clandestine group in Naples for some time; his ideas, largely exploited in Europe by plagiarism, show clear resonances with Lucretius.

6. Tielhard de Chardin, pp. 109-32.

7. Annus Mundi—Year of the World; cf General Tables of the *Fasti Catholici* or *Fasti Temporis perpetui* from 1 a.m. of the year 4004 B.C. to 6004 a.m. of the year 6000 A.D.

8. This similarity had been already noted by Galen, whose knowledge about anatomy was largely based on the dissection of apes. Only during the late Middle Ages—by order of the Pope—did anatomists begin to abandon the taboo concerning the dissection of human corpses.

9. His theory was based on an atomistic dualism: all matter possesses a certain degree of sensibility, intelligence and memory. The influence of Lucretius and Vico are noticeable here.

10. This history comprises 44 volumes!

11. Blumenbach, *Collectio; Institutiones*, vol. 4.

12. Lamarck.

13. He also introduced the term "biology" into science.

14. There are many points that remain unanswered by the purely neo-Darwinist scenario. The highly complicated and complex structures in many features of existant fauna, including the human species, evidently transcend currently proposed explanations.

15. Chief of the tumor cell biology laboratory, National Cancer Institute.

16. Institut Pasteur, Paris. He sent to Gallo a specimen of the French isolate of the AIDS virus that Gallo claims to have discovered.

17. Cuvier.

18. This work was translated into Italian and French and was republished twice (1740, 1757).

19. Kant (1797), A 365-6, note.

20. Ibid. Cf., "Matter, which is the basal stuff of all things, is...bound to certain laws. Left to them, it must produce, by necessity, beautiful combinations. It does not have any freedom to deviate from this plan of perfection. Since it is thus in the state of being submitted to the wisest

intention, thus it must be placed by necessity into such harmonic conditions by a first cause that rules over it, and therefore, there is a God, just because nature, even in chaos, cannot be otherwise than regular and orderly." Ibid., XXIX-XXX.

21. Ibid., A XXXIV-XXXV.

22. Akademie Ausgabe T.8, 54.

23. Kant (1797), A 376.

24. Hegel, par. 339.

25. Ibid., par. 249.

26. The first edition sold out in one day.

27. The opus was published anonymously. The author was identified only in 1884, years after Darwin's death.

28. Historical sketch from the sixth edition, p. 58.

29. Cf. selected articles in Hinske.

30. He was not one of the really great scientists of his time. Certainly his books sold enormously well—the same is true today for the popularizing works of writers of a materialistic bent. Vogt's book were considered to be outdated in the first half of the twentieth century, especially in as much as his defense of a materialistic worldview is concerned. The 1934 edition of the encyclopedia, *Der Große Brockhaus*, still devoted seventeen lines to him, though more recent editions stopped mentioning him.

31. Chadwick, p. 167.

32. Draper, pp. 321ff.

33. *Omnes religionis veritates ex nativa humanae rationis vi derivant; hinc ratio est princeps norma, qua homo cognitionem omnium cuiuscunque generis veritatum assequi possit ac debeat.* (D. 1704)

34. *Divina revelatio est imperfecta et idcirco subiecta continuo et indifinito progressui, qui humanae rationis progressui respondeat.* (D. 1705)

35. *Si quis praeter materiam nihil esse affirmare non erubuerit: Anathema sit.* (D. 1802)

36. *Si quis dixerit, res finitas tum corporeas tum spirituales aut saltem spirituales e divina substantia emanasse, —aut divinam essentiam sui manifestatione vel evolutione fieri omnia, —aut denique Deum esse ens universale seu indefinitum quod esse determinando constituat rerum universitatem in genera, species et individua distinctam: A. S.* (D. 1804)

37. *Si quis dixerit, rationem humanam ita independentem esse, ut fides ei a Deo imperari non possit: A. S.* (D. 1810)

38. *Si quis dixerit, disciplinas humanas ea cum libertate tractandas esse, ut earum assertiones, etsi doctrinae revelatae adversentur, tanquam verae retineri neque ab Ecclesia proscribi possint: A. S.* (D. 1817)

39. *Si quis dixerit, fieri posse, ut dogmatibus ab Ecclesia propositis aliquando secundum progressum scientiae sensus tribuendus sit alius ab eo, quem intellexit et intelligit Ecclesia: A. S.* (DS 3043)

40. Strauß.

41. Translates as *Doctrine of Food—for the People*. Today it would be *Manual of Dietetics—for Everybody*.

42. Feuerbach, p. 1082.

43. After a short time as lecturer at the University of Tübingen, he established himself as a general practitioner in Darmstadt. *Kraft und Stoff*, 1855. *Natur und Geist*, 1857. *Physiologische Bilder*, 2 volumes, 1861 and 1975. *Die Darwinsche Theorie von der Entstehung un Umwandlung der Lebewelt, 1868; Der Gottesbegriff und dessen Bedeutung für die Gegenwart*, 1874; *Am Sterbelager des Jahrhunderts*, 1898; *Im Dienste der Wahrheit*, 1899.

44. Büchner, p. 95.

45. Ibid., p. 254.

46. "Monistenbund," which asserted the essential unity of inorganic and organic

nature. Haeckel's propagandism was a chief factor in the success of evolutionary doctrine in Germany.

47. Newman, Doc. A.18.21, Birmingham Oratorium. Quoted from Wildiers, p. 275, n. 75.

48. Newman, *Sundries*, p. 83. Quoted from Wildiers, p. 275, n. 75.

49. This position is much closer to that of modern chaos researchers. Cf. Kauffman.

50. The second volume of Dorlodot's work was never published. Dorlodot influenced the thinking of Teilhard de Chardin.

51. Cf. Cuénot.

52. Bautz.

53. Dostoevsky, ch. 2.

54. Cf. Bégouin.

55. The attempt by Prof. Charles Moeller, of the University of Louvain, to interpret the encyclical openmindedly landed on the *Index*, still existing at that time. See Catholic Church, p. 25.

An eminent scholar in the science-and-religion field, Karl Schmitz-Moormann was Professor of Philosophical Anthropology and Ethics at the Fachhochschule Dortmund. Author of many articles and books in German, he and his wife, Nicole Schmitz-Moormann, also translated and edited works of Pierre Teilhard de Chardin. For more than thirty years, with lectures on four continents and as a visiting professor at schools in the United States and Australia, he worked to develop the vision of Teilhard. He was cofounder and first President of the European Society for the Study of Science and Theology (ESSSAT). He died suddenly in 1996 at Princeton, New Jersey, where he was Fellow at the Center of Theological Inquiry. In this essay, he observes that "no theologian today is seriously concerned about scientific theories such as the theory of evolution," and then makes a self-reference with the quip, "—though exceptions do make the rule." His last book, Theology of Creation in an Evolutionary World, *written in collaboration with James F. Salmon, S.J., was published posthumously in 1997 by Pilgrim Press.*

He presented this paper at Boston University School of Theology in February 1993, an event cosponsored by the Center for Faith and Science Exchange, the Boston Theological Institute, and the American Scientific Affiliation.

Fifteen Billion Years of Searching for God: Neither Science nor Theology Can Afford to Be Dogmatic

Daniel Lee Kaplan

This essay argues that, in the search for truth, the findings of both science and theology are provisional. The author makes a strong case for clergy to stay informed about current science and technology, so that they can challenge their congregations to be skeptical and to develop a mature faith that serves the needs of contemporary life. He sets a healthy example, raising thoughtful questions about the nature of God and the universe.

Introduction

We are here tonight as scientists and religionists, hopefully, in a common pursuit of truth. That may be where our similarity ends. It is told that three men of different occupations were looking at the Grand Canyon. The archaeologist said: "What a wonder of science!" The clergyman said: "One of the glories of God!" The cowboy said: "A heck of a place to lose a cow!"

Some think of God as the Truth. Others of more humility reconcile themselves to finding truths. There is a Midrash that asks: If God had a signature, what would that be? The answer: God would use the first, middle, and last letter of the Hebrew alphabet. That would symbolize all knowledge. But those three letters also spell a Hebrew word, *EMET*, which means Truth.

We get carried away with our own powers of discovery, but given that we have minds, it would be a travesty not to use whatever capabilities we have to understand more of the universe. An anecdote is told about George Washington Carver, the botanist who achieved wonders with the humble peanut. It is said that when he was young, Carver used to ask God to tell him the mystery of the universe. The answer that came to him was that such knowledge was reserved for God alone. So, then Carver ask for the mystery of the peanut. And God said, "Well, George, that's more nearly your size." And then God told him.

Those religionists who are not fundamentalists wrestle with every major scientific breakthrough from astronomy to zoology, creation, evolution, cloning, sex reversals, lobotomies, transplantations. I recently heard about placing a microchip in the brain of a stroke patient, enabling him to send out directions. The list is unending.

And now, many whose lives have been dedicated primarily to one of the numerous scientific disciplines are searching for other truths in a totally nonrational approach to religion or—to use the very popular word these days—spirituality. The cover story of a July issue of *Newsweek* magazine was entitled "Science Finds God."[1] I envy those scientists; I am still searching!

The dangers of dogmatism

Except for isolated individuals in the past, this is a new phenomenon. Most clergy are poorly acquainted even with other religions. And in my early days in the Rabbinate, I wondered how scientifically brilliant members of my congregation were not embarrassed to express such an infantile approach to faith, to the texts, to ritual in our own tradition.

The so-called conflict between religion and science was foremost—ignorance. That soon translated into a hardening of positions, wherein both became dogmatic. Instead of being partners in the search for truth, they became enemies. Each side proclaimed what the other side believed, stating the case, making the accusation, and finding them guilty.

There are those, far too many for my liking, who have not moved from that position. They know that they possess the truth and all who do not conform are either heretics or irrational dolts, depending on which camp you are in.

I must admit that I have little patience with the revelationists whose direct pipeline to God enables them to dismiss the challenges of the doubters. That is a formidable number of people in our so-called sophisticated, technologically advanced society. Statistical surveys say that approximately half of American Christians (Catholics and Protestants) are, in essence, fundamentalist. Some 40% actually believe that there is a Devil, a true being ruling the domain of Hell (wherever that is).

Orthodox Jews are also fundamentalists, who believe that only the Revelation to Moses is true while all other claims are products of creative imaginations. These Biblical literalists insist that the words of scripture are unimpeachable, and any theory of science cannot be true if it disagrees with the sacred text. The matter is not confined to Genesis, creation accounts, and evolution. Ethical behavior is of profound relevance because the Bible is the source of ethics. The Hebrew Bible posits the theory of Ethical Monotheism. That means God must act ethically—in sharp contrast to the deities of ancient Greece and Rome—being, in fact, bound by God's own laws of ethics. But one must do many mental gyrations to justify such acts of God as a Flood that wiped out all humankind, except Noah and his family. And why did God create all those nations with their gods who demanded human sacrifice and sex acts with holy prostitutes to ensure fertility of crops? (It certainly would ensure male attendance at services!)

Who is responsible for all the evil in the world? It is not a good enough answer—unless one is a humanist—to blame all events on people. Of course if there is no God, there is no theological problem. But who wants a god less compassionate than oneself?

And why did a Jewish God who intervened so often in biblical history, and who, according to Christians, intervened once more by sending the Son of God to save humankind, suddenly do a disappearing act in modern times? Where was God when the Black Death struck down millions in Europe? Where was God during the Holocaust? Emil Fackenheim's answer was, "In times of darkness, Jews have to contend with a silent God." Where was God's intervention when Stalin slaughtered millions, when Mao massacred millions more? Others posit that the ways of God are a mystery. But that turns religion into magic, and God is the disappearing magician.

Where is God now, with Bosnia, Kosovo, Tibet, Rwanda, or during hurricanes, tornadoes, earthquakes, and floods?

Does God only appear only to the faithful at worship services or in an occasional vision? Is God's relationship to ethical principles mental and not physical? Could it be indifference? Elie Wiesel has stated that this is the worst sin of modern times: to watch, to be a bystander and do nothing to reach out to one in need. Or can we admit that God is limited and not omnipotent? God might not be omniscient either!

What does *imitatio dei*—imitating God—mean for the modern, sensitive person? Who is responsible for all the evil in the world? It is not a good enough answer—unless one is a humanist—to blame all events on people. Of course if there is no God, there is no theological problem. But who wants a god less compassionate than oneself?

Openness to uncertainty in the pursuit of truth

Besides the fundamentalists, it may be equally difficult for more open-minded thinkers to allow every theory, scientific *or* religious, to be questioned, by anyone at anytime. And yet, it seems to me, that is the bottom line in an honest pursuit of truth.

I was raised in a liberal, thinking and questioning home. My experiences in Bible classes in rabbinic seminary merely extended an awareness that the Creation Story was not just poetry, but myth—and, indeed, there were two versions of the myth in Genesis. My teachers also made me aware of the fact that every culture has the psychic need to create a myth of origin. It seems that same psychic need, which is deeper than curiosity, has prompted this century's deepening astronomic research, resulting in the more or less general acceptance of the Big Bang theory.

Whether creation occurred thirteen or fifteen or eighteen billion years ago is irrelevant to me. However, being the rationalist that I am (at least some of the time), I must admit that talk about this ever-expanding universe, beginning from a pinpoint, requires greater faith and suspension of the rational than accepting even a modified version of the Biblical account of creation.

I quote from a recent article by Gregg Easterbrook in *The New Republic* magazine:

> When the Big Bang sounded, the universe expanded from a pinpoint to cosmological size in far less than one second—space itself hurtling outward in a torrent of pure physics, the bow wave or the new cosmos moving at trillions of times the speed of light. You believe that this process unleashed such powerful distortions that, for an instant, the hatchling universe was curved to a surreal degree. Extreme curvature caused normally rare "virtual particles" to materialize from the quantum netherworld in cornucopian numbers, the stuff of existence being "created virtually out of nothing," as *Scientific American* once phrased it.
>
> Further, you believe that, as subatomic particles began to unbuckle from the inexplicable proto-reality, both matter and anti-matter formed. Immediately these commodities began to collide and annihilate themselves, vanishing as mysteriously as them came. The only reason our universe is here today is that the Bang was slightly asymmetrical, its yield favoring matter over anti-matter by about one part per 100 million. Owing to this, when the stupendous cosmic commencement day ended amid sundering energies beyond comprehension, a residue of standard matter survived, and from it the galaxies formed. That is to say: You believe that a microscopic, transparent, empty point in primordial space-time contained not just one universe but enough potential for 100 million universes.

It may not be difficult to see why most religious fundamentalists find this a strain on belief. Indeed, one does not even have to believe in God to find this mind-boggling. A Orthodox Jew, Gerald Schroeder—the author of two books, *Genesis and the Big Bang* and *The Science of God*—in trying to reconcile the Big Bang theory and evolution with the biblical account of creation in Genesis, writes:

> [T]he first 6 days were no longer than the 6 days of our work week, but they contained all the ages and

> all the secrets of the universe.... Einstein's laws of relativity taught the world that the passage of time and the perception of time's flow varies from place to place in our most amazing universe.... We look back while the Bible looks forward and as we look back, the universe becomes smaller and smaller.[2]

To Schroeder, "Genesis I and science tell the same account, but seen from vastly different perspectives." It's somewhat refreshing to find an Orthodox Jew accepting or even advocating such an approach, in the face of others who deny even the existence of dinosaurs. One group of fanatics in Israel protested against a company that placed pictures of these "nonexistent" creatures on milk cartons in order to deceive young Orthodox children.

Scientific research has brought to light another serious problem: the aspect of randomness, which also brings in the subject of chance. What truly opened my eyes to that other world were the writings of Carl Sagan. To the pure scientist he might be looked upon as a mere popularizer. To me he was a Rebbe, a teacher of *EMET*, more truth, more knowledge. Following are several ideas Sagan has taught me.

> The universe doesn't care about itself. It creates beyond its control, creatures of destruction, from dinosaurs to viruses, such as cancer.
>
> Darwin laid the groundwork; many have brought much of his research up to date. He wrote of natural selection and survival of the fittest. Natural selection is ruthless. Survival of the fittest is not necessarily true.
>
> A present estimate of all species is over 10 million. Scientists hold that 100 species become extinct each day and we are acquainted with less than 10% of the total. Many species are becoming extinct before we even know of their existence.
>
> Most of the billions of species of life that have ever lived are extinct. Extinction is the norm; survival is the triumphant exception. 65 million years ago most of the species on earth were snuffed out, probably because of a massive cometary or asteroidal collision.

Let us assume that the universe is fifteen billion years of age. Was that original pinpoint hovering in space, or where did it come from? Was that all of existence, including space? Was space, too, nonexistent? Or did space always exist? Did God come into being with the Big Bang? Or was God that high-energized pinpoint? Or did God exist before the Big Bang?

How self-confident was God the Creator? The Midrash says that God created several worlds before this one. They didn't please God, so they were destroyed. God wasn't enamored of this one either, but just gave up.

I saw a cartoon recently that pictured God as a bearded figure, sitting behind a desk with a globe of the Earth on it. It was entitled: "God complains about his job." The second frame had God saying, "The hours stink and there's no chance to move up." So, is God the imperfect Creator, or among the created? Is it part of God's nature to create, come what may? The prophet Isaiah says that God is the ultimate source of everything—"I form the light, and create darkness: I make peace and create evil."[3]

Besides the fundamentalists, it may be equally difficult for more open-minded thinkers to allow every theory, scientific or religious, to be questioned, by anyone at anytime. And yet, it seems to me, that is the bottom line in an honest pursuit of truth.

Too often Jews and Christians, especially in the Western hemisphere, believe they have a monopoly on the truth. Listen to a passage from Hindu sacred literature. The major deities, Vishnu, Siva, and Devi have a

supporting cast of thousands of gods. The Brahman poets in the Rg-Veda voiced their courageous doubt in their *Hymn of Creation*:

> Who verily knows and who can here
> declare it, whence it was
> born and whence came this
> creation?
> The gods are later than this world's
> production. Who knows,
> then, whence it first came into
> being?
>
> He, the first origin of this creation,
> whether he formed it all
> or did not form it,
> Whose eye controls this world in
> highest heaven, he verily
> knows it, or perhaps he does not.[4]

What does "eternity" mean? Was there time before fifteen billion years ago? Could eternity exist in nonexistence? Is God eternal? Or are these terms essentially meaningless now? To me it is ludicrous when people talk about life eternal. Of course, they are talking about the future and not the past.

The Midrash says that God created several worlds before this one. They didn't please God, so they were destroyed. God wasn't enamored of this one either, but just gave up.

But if we get wrinkled now in our eighties, imagine what we would look like after a few billion years! And I assume the earth will continue at least for that period.

Carl Sagan has written:

> Evolution suggests that if God exists, God is fond of secondary causes and factotum processes: getting the universe going, establishing the laws of nature, and then retiring from the scene. A hands-on Executive seems to be absent; power has been delegated.[5]

Evolution suggests that God will not intervene, whether beseeched or not, to save us from ourselves. Evolution suggests we're on our own, that if there is a god, that god must be very far away.

Black smokers bubbling up from the ocean floors at temperatures exceeding 200 degrees Fahrenheit may have been where life in the form of microbes first appeared. Recent tests show these microbes can also survive extremes of cold. Sagan writes about a self-replicating, catalytic RNA molecule as the first living thing in the ancient oceans about four billion years ago, its close relative, DNA, being a later evolutionary refinement. There was an endless chain of adaptations, many of which didn't work. Molecules simply produce a steady stream of varieties. Every DNA is vulnerable to mutation. Randomness is more prominent that natural laws of progress. Life just doesn't know where it's going.

We are continually barraged by new scientific theories. They are fascinating to say the least. About fifteen years ago, the existence of stars composed exclusively of quarks was hypothesized. A quark, as I understand it, is composed of both a strong and weak force within each atomic particle. Scientists named these hypothetical stars "strange stars." However, as yet no strange stars have been identified. That one must take on faith!

In mid-October, a Nobel Prize was awarded to scientists who were able to divide the charges in an electron. This was affirmed by a team of physicists at the Weizmann Institute of Science in Israel. Electrons have traditionally been defined as tiny particles that carry the smallest negative charge in nature. A current made up of fractions of electronic charges would therefore seem just as absurd as describing a crowd as being composed of fractions of people. However, the only explanations scientists can devise for certain behavior of electrons are based on the assumption that electrons only seem to be fractionated.

Not too long ago, scientists posited the theory that most galaxies probably have a black hole—which is like a vacuum cleaner,

sucking in debris, stars, whatever comes its way. Our own Milky Way probably has one at its center. A black hole cannot and will never be seen, and yet the theory further states that its weight is three million times that of the sun. It is governed by quantum gravity. Is this where all existence might end up? Might this theory also be sucked up?

Religion's internal impetus to change

Religion is also undergoing challenges from within its own ranks. We can make peace with scientific discoveries easier than reconciling ourselves to religio-philosophic views of our theologians over the millennia.

Being the rationalist that I am (at least some of the time), I must admit that talk about this ever-expanding universe, beginning from a pinpoint, requires greater faith and suspension of the rational than accepting even a modified version of the Biblical account of creation.

The first real departure in Judaism from a personal deity came with the medieval Jewish philosophers, in particular Maimonides, who concluded that God was the Intelligence of the universe. It's a school of thought that has led to Einstein and the acceptance that laws of Nature point to such a power. Randomness and chance are not considered.

A modern Jewish thinker, Mordecai M. Kaplan, the founder of Reconstructionist Judaism, referred to God as "the Power that makes for salvation." He called his religious approach "transnaturalism," denying absolutely a supernatural deity, while not wholly satisfied with a down-to-earth humanism. However, salvation for Kaplan would be the this-worldly, fulfilling, psychological ideals of such writers as Fromm and Maslow.

The most recent challenge of and by Jewish and Christian thinkers is called Process Theology. The thoughts I now share with you are from my colleague Rabbi William Kaufman's book, *The Case for God*. He begins by accepting the atheistic challenge, which, he admits, is formidable. When he once asked the American philosopher, Willard Van Orman Quine, why he pronounced a theory of atomistic materialism, Quine told him that God is an unnecessary hypotheses. Quine sees science as the only route to truth. Questions of ethics and moral values are completely human in origin. Quine readily admits that belief in God can be comforting, but rejects the argument that design is enough of a reason for belief in a Creator.

Alfred North Whitehead[7] admits that we cannot know anything beyond this temporal world, so that if a God exists, that God must be immanent and not transcendent. God is eternal while all other entities are temporal. But since everything is in God, part of God is also temporal. Whitehead concludes that the world is too complex to be random. For Whitehead, the order we find in nature cannot be accounted for without the assumption of the existence of God as the "ordering entity." However, we must think of God in a completely different way than religions have in the past—and most, up to the present. God is not King of Kings. In fact, Whitehead's God is very much limited, working by persuasion rather than force. This God is the source of all new possibilities—good *and* evil—incorporating themselves, as well as all events, natural phenomena from electrons to tornadoes, chaos and order, novelty and structure. Nature makes choices and we make choices. However, the bifurcation of nature into mind and matter is wrong and leads to our sense of alienation. But ultimately Whitehead, philosopher, mathematician, man of sciences, thoroughly conversant with the theory of evolution, takes a leap of faith. God is not only the continuing source of becoming and

the ordering entity of the universe, but is a being with whom one can enter a relationship of communion and trust. He even says that God suffers, which seems to me an attempt to restore some of his early Christology and wrap it in sheepish mysticism.

I would say that the foundation for all process theologians is Spinoza.[8] His pantheistic view of *Deus sive Natura*—God and Nature are the same—is the starting point for modern theories. Just as every individual is both being and becoming, as is Nature, so do the modern thinkers devise new concepts of God to reflect this same process. Charles Hartshorne[9] extends Spinoza's pantheism to panentheism, i.e., the universe is within God. Hartshorne writes that it is inconceivable to think of non-being, of pure nothingness. Therefore, there must be at least one individual—God—who exists necessarily. Kaufman points out that much of Hartshorne's philosophy is intuitive. Hartshorne also states that complete cosmic chaos is inconceivable. Are there not laws of nature? This old argument from design is frequently challenged by scientists and is part of a running argument that will continue, at least for decades. To Hartshorne, it is irrational to choose not to believe in God. Humanism is inadequate, because "to say nature is godless is to say that it is not basically intelligible." For him, the ultimate intelligibility and integrity of the universe is basic, an ontological presupposition.

There are many other process theologians; I just wish to give you a taste, because it seems to me that no further analysis of ancient and medieval views of God is needed or relevant for contemporary seekers after truth. Talmudic *pilpul* and medieval scholasticism are diversionary bleeps on the continuum of philosophic and religious inquiry.

Other perplexities, religious and scientific

Both Hebrew and Christian scriptures, although each has different emphases, are books of faith. They are not scientific texts. There were no stenographers trailing along with Moses or Jesus, and the record of their revelations is, at best, secondhand reporting. Any individual's claim, in any period of history, is his or her reality *only*. Others may wish voluntarily to accept it as truth and even form groups of followers. So be it. But that claim is not empirical nor subject to any rational testing. Any group's dogmatic claim to exclusivity is nonsense. If there is a god, that god must be god of the universe and *all* humanity. Also, it seems to me there is little difference if a certain culture believes in one God while others hold to many deities. The bottom line is the ethics of existence. Any interpretation of a tradition is morally bankrupt if it justifies the bombing of abortion clinics and cold blooded murder of physicians, or portrays acts of terrorism as warranted and pleasing in the eyes of God. But can we complain about moral bankruptcy among peoples, if God *can* and yet *does not* intervene with all the human tragedies that abound? Where do we get our sense of ethical?

I mentioned several problems presented by scientific findings. Here are a few more questions: How fast is our universe expanding? Despite the enormity of our universe with a hundred million galaxies, and billions and billions of stars, is it the only universe? Might there be other universes, some smaller, some larger, out in infinite space? Why not multi-universes? Is there a God for each universe? Polytheism might be right after all!

So many scientific theories are mathematical constructs. Most of us think of reality in terms of four dimensions. Several years ago I read about ten dimensions. The last six, I was told, are mathematical formulae. Under the same rubric comes the more recent "superstring theory," in which all fundamental particles are made of incredible tiny loops of enormous tensile strength. The way they vibrate generates the entire two hundred particles. What are superstrings made of? Nothing. They are a mathematical construct.

How does the brain remember, and how did consciousness come about? How did it emerge from the brain's complicated molecular structure? What will the human brain be like in the next millennium? Arthur Koestler has written that in the course of evolution human beings have progressed from instinct to emotion to rationality. As you recall, Aristotle wrote that "man is a rational animal." My own postscript is: Yes, every once in awhile. Of course, tonight is one of those rare moments!

Why are we usually mired in our emotion? Why are our animal needs so overpowering? Why can we not get a handle on our hostility? And yet there is something special about human beings. We are creators of art, music, and literature. Why this aesthetic need? We do not need these for survival, but they certainly enhance our lives.

TOE is the abbreviation for Theory of Everything. That is what we really seek. Some believe science will arrive at the ultimate unifying equation. Some believe religion already has arrived there in the being of God. And some of us are humble enough to admit that we don't know very much about either. Martin Gardner, in a recent essay entitled "Science and the Unknowable," wrote:

> There is no escape from the superultimate questions: Why is there something rather than nothing, and why is the something structured the way it is? As Stephen Hawking recently put it, "Why does the universe go to all the bother of existing?"

For fifteen billion years our universe, we suppose, has been in existence. Ever since our first ancestors began seeking answers to their origins, the quest has been unrelenting. If we don't destroy ourselves in the meantime, we should arrive at a few more answers every billion or so years.

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Endnotes:

1. See Begley.
2. Schroeder (1998), p. 15.
3. Isa 45:7.
4. Rg-Veda 10.129. See Renou, p. 68.
5. Sagan and Druyan, p. 67.
6. See Kaufman.
7. See Jones.
8. See Kaufman.

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The Missing Face of Ecology in Pauline Theology: Conservation of Mass-Energy in Reconfiguring Immortality as Everlastingness

Nicole Roskos

The early Judaic affirmation of generation(s) *and earthly incorporation, a value of ecological potential, is undermined by the resurrection theology of Paul. The author argues that, when the first law of thermodynamics is taken into consideration, a reconstruction of a more ecologically responsible conception of immortality emerges.*

> His disciples said to him, "When will the kingdom come?" [Jesus said] "It will not come by waiting for it. It will not be a matter of saying 'here it is' or 'there it is.' Rather, the kingdom of the father is spread out upon the earth, and people do not see it."
>
> —The Gospel of Thomas 138[1]

> His disciples said to him, "When will the repose of the dead come about, and when will the new world come?" He said to them, "What you look forward to has already come, but you do not recognize it."
>
> —The Gospel of Thomas 51[2]

On Earth, death is essential to the regeneration of life. Decaying matter is composed of nutrients "regenerated into forms that can be reused by plants, by the activities of the countless worms, snails, insects, mites, bacteria, and fungi that consume detritus (dead material)...as food."[3] While the notion of reincorporation into the earth is identifiable in the early Judaic tradition of "dust to dust,"[4] Pauline theology tells a different story:

> What is sown is perishable, what is raised is imperishable....For the perishable body must put on imperishability, and this mortal body must put on immortality....Death will be swallowed up in victory.[5]

This essay will explore these opposing views of death and the renewal of life in early Judaic thought, Pauline theology, and their respective ecological and cosmological implications. The objective is twofold: 1) to describe the early Judaic blessing of earthly *generation(s)* and its struggle in the first century C.E. with an ecologically resistant, Pauline ideal of immortality; and, 2) in affirmation of ecological *generation(s)*, to use the law of conservation of mass-energy as a tool for reconsidering the Pauline Spirit in an everlasting universe.

Genesis

To understand how death is constructed in early Judaic cosmology, the descriptions of creation in the book of Genesis are important..

Birth from the earth:

> "Let the earth put forth vegetation: plants yielding seed, and fruit trees of every kind on earth that bear fruit with the seed in it" (1:11).

Birth from its waters:

> "Let the waters bring forth swarms of living creatures, and let birds fly above the earth across the dome of the sky....God blessed them saying, 'Be fruitful and multiply and

fill the waters in the seas, and let birds multiply on the earth'" (1:20, 22). Humankind too are encouraged to "be fruitful and multiply" (1:28). And all of "[t]hese are the *generations* of the heavens and the earth..." (2:4).

In considering *generation(s)* as a predominant theme of Genesis there is an initial implication of sustenance: "See, I have given you every plant yielding seed that is upon the face of the earth" (1:29). Not just to humankind, but "to every beast of the earth, and to every bird of the air ...everything that has the breath of life, I have given every green plant for food" (1:30). Earthly sustenance has death built into its logic; essentially, these plants die when consumed. But in sustaining new life, could plant death simply imply a transformation of energy? A dying plant ultimately relinquishes its identity as a plant, whereas the elements of its body live on and are transformed through the food chain.

However death is defined, then, either as the loss of an individual life or as incorporation into new life, the book of Genesis affirms a fundamental tenet of contemporary ecology—the food web. Producers such as plants transform sunlight, water, and carbon dioxide into glucose and oxygen. Consumers ingest these plants or other consumers, while decomposers (bacteria and fungi) feed off of all dead matter, breaking it down into those nutrients essential to a plant's survival.[6]

"Plants yielding seed of every kind" (1:12) initially has the message of *generation(s)* woven into it. The seeds signify death when they signify life. "It is the power of fertility that makes the continuance of the species possible,"[7] the continuance of *all* species. Genesis 1:11 repeatedly emphasizes the generational capacity of birth: "Let the earth *put forth* vegetation, plants *yielding* seed, and fruit trees of every kind that bear *fruit* with the *seed in it*." Death is encoded in the generation of both plant and animal bodies. Thus, the theme of *generation(s)* in Genesis affirms the life-death cycle, making this text a powerful source of ecological wisdom. In Earth's ecosystems, *generation* marks both the flow of energy from producers through decomposers and the flow of energy through reproduction from one generation to the next.[8]

Death is forever inscribed in the story of Genesis when the generations are said to return to the earth from which they emerge (3:19). Earth is the root of generation and the body of incorporation. All life is born of earth, consumes or is consumed, and returns to the earth in death. This connection to the earth is an essential component of the generational theme. For humanity, earthly contiguity is emphasized in the *ha-adama/ha-adam* (earth/earthling) wordplay:

> [T]hen Yahweh God formed the earth creature [*ha-adam*] of dust from the earth [*ha-adama*] (2:7).[9]

Lyn Bechtel calls the relationship in Genesis between earth and earthling a "differentiated unity":

> The human's original unity with the ground establishes an intimate relatedness that is always retained (as an adult, the human's primary role will be to cultivate the ground to produce food, 2:5; 3.23).... Unity and separation are an essential dynamic that continues throughout life, beginning in the separation of life (birth) and ending in the return to unity with the ground in death (3:19).[10]

"Dust to dust" reunion with earth is indirectly emphasized in Genesis when any attempt to live forever is banned in the forbidden tree of life (3:22).

The sin/fall interpretation

To this point, this discussion of Genesis has purposefully ignored the sin/fall interpretation. The reading of the story of Eden as "the Fall" seems to have been constructed through a Hellenistic lens that favored immortality. The concept of resurrection, stemming from Zoroastrian religion, emerged in Jewish apocalypticism, which in turn was influenced by "the Hellenistic milieu" of life-

after-death traditions.[11] Emphasis on heaven as the site of immortality, or "astral immortality,"[12] established an apparent dualism that favored an immortal heaven over a mortal earth.

The sin/fall interpretation stands in contrast to the early Judaic view of death as integral to life, of earth as the source and destination of bodies. Its ideals of immortality render death a punishment, ultimately negating the very meaning, in Genesis, of *generational* earth. The sin/fall interpretation demonstrates little if any viability in the text of Genesis and subsequent Judaic scripture. Scholars have questioned the stark absence of any 'sin,' 'Fall,' or 'punishment' references to the Eden story throughout the whole of the Hebrew Bible, "despite the plentiful opportunities—particularly in the prophets."[13] Some hints of the beginnings of a sin/fall type of interpretation emerge much later, from the third century B.C.E., in Ecclesiasticus and the Wisdom of Ben Sira.[14] The "ideas of a 'Fall' came into the Christian world through Orphic thought...found in the *Phaedrus*, where Plato describes heavenly perfections shedding their wings and falling to the earth to be implanted and born as humans."[15] Thus, Carol Meyers concludes that "it is more appropriate to drop the term 'Fall' from any reference to the story in its Hebraic context."[16]

However death is defined, then, either as the loss of an individual life or as incorporation into new life, the book of Genesis affirms a fundamental tenet of contemporary ecology—the food web.

Immortality: Christian theology eats of the tree of life

The story of Eden assumes a radically different form in early Christianity. The works attributed to Paul clearly and firmly establish a system of death versus immortality in his interpretation of Adam. Paul constructs a "divided self"[17] along the lines of a Christ/Adam dualism, analogous to life/death.

> For since death came through a human being, the resurrection of the dead has also come through a human being; for as all die in Adam, so all will be made alive in Christ....The last enemy to be destroyed is death.
> (1 Cor 15:22-26)

According to Paul, the transgression of Adam causes death. In turn, Christ's death and resurrection essentially breaks the *ha-adam/ha-adama* continuity. Paul's Christ frames the familiar conception that humans may be liberated from "bondage to decay" (Rom 8:19-23) into a heavenly eternal life. But Paul tells us:

> [I]t is not the spiritual that is first, but the physical, and then the spiritual. The first man was from the earth, a man of *dust*; the second man is from *heaven*.
> (1 Cor 15:46-47, emphasis added)

And so it is with the resurrection of the dead that the ecologically impossible happens: the immortalization of bodies. "The dead will be raised imperishable" until "Death has been swallowed up in victory" (1 Cor 15:50-54). Having reinterpreted Genesis, Paul effectively "eats" of the Tree of Life.

Why was immortality so important to Paul? Why this urgency to be freed from the "bondage to decay?" Paul reads Adam's sin as an initiation of death; the fleshly side of the self harbored a state of both sin and mortality. In contrast, Christ symbolizes the aspect of the self that participates in the spiritual life with an ability to do good, to the point of being liberated from sin and death. By equating sin with death, Paul finds the goodness of Christ, not simply in living the virtuous life, but also in the belief that he was

resurrected after his death. Thus, salvation has come to mean goodness in this world, and goodness has come to mean immortal life.[19]

Does Paul not encourage a *generational* message in the recycling of physical bodies through the resurrection? In reference to 1 Cor 15:38-58, Joel Green is one of many scholars who have noticed in Pauline theology a "profound continuity between present life in this world and life everlasting with God."[19] For instance, Paul symbolizes the logic of resurrection through a simple observation of nature: "What you sow does not come to life unless it dies" (vs 36). Paul's message takes a turn against nature, however, upon the introduction of his preference of the spiritual body of heaven over and against the physical body of earth. His discrimination against the earthly or physical becomes clear as he declares that "what is sown is perishable"(vs 42) and in a state of "dishonor" and "weakness" (vs 43); these "sown" aspects are to be ultimately escaped in the resurrection. Eventually, this spiritual or heavenly body will be victorious, as "the dead will be raised imperishable" (vs 52).

Distinct from the preresurrected, the resurrected body is again described by Paul, ironically using nature as an analogy: "like a flower compared to its seed" (1 Cor 15: 36-38). An attempt to comprehend the kind of body resurrected was obviously important in Paul's context. In his book *The Corinthian Body*, Dale Martin speculates that, despite evidence that many Jews and Christians at the time equated resurrection of the body with resurrection of the corpse, Paul rejected the resurrection of flesh and blood.

What kind of body *is* to be resurrected for Paul? His response to this question evokes a hierarchical view of Creation. Those of the flesh (*sarx*), i.e., humans, beasts, birds, and fish—terrestrial bodies—are posited as being lesser than the celestial bodies (*soma*) (1 Cor 15:39-40). Martin claims that Paul's designation of terrestrial bodies as initially *sarx* and the celestial as *soma* caters to a physiological hierarchy, favoring the celestial over the terrestrial. "The switch in terminology is the first clue as to how important a physiological hierarchy is for Paul's own conception of the resurrected body." The resurrection "will partake of a nature similar to that of heavenly bodies and will be as much higher than the current earthly body in the physiological hierarchy as the heavenly bodies are in comparison to earthly bodies."[20]

Martin emphasizes that those translations which posit a "physical body" against a "spiritual body" are faulty, because audiences are blinded by a Cartesian material/immaterial dualism, quite contrary to Paul's intentions. Martin suggests the two bodies would be better translated as pneumatic body/psychic body (*soma pneumatikon*/*soma psychikon*). He argues that to be true to the context both kinds of bodies must be considered to be *material*, composed of different substances. The resurrected, "pneumatic," body was believed to have a higher nature, since *pneuma* was airy and illuminous and therefore finer in substance than the denser, decay-prone psychic body.[21] Martin explains:

Paul's message takes a turn against nature, however, upon the introduction of his preference of the spiritual body of heaven over and against the physical body of earth.

> According to Paul, the resurrected body is stripped of flesh, blood, and soul (psyche); it has nothing of the earth in it at all, being composed entirely of the celestial substance of pneuma...and hence the possibility for immortality.[22]

Conserving *generation(s)* and the conservation of mass-energy

As previously argued, the book of Genesis harbors an ecological message of *generation*: organic creation, reproduction, and reincorporation into earth through death. John Cobb explained the contemporary problem of human *generation(s)* by claiming simply that humans have *already fulfilled* the commandment to be fruitful and multiply.[23] Human overpopulation threatens all generations of life. It is also "consuming resources faster than new resources are being regenerated by the biosphere, all the while pouring forth so much waste that the quality of the environment in most regions of the earth is deteriorating at an alarming rate."[24] In this sense, extinctions born of human over-exploitation blaspheme the name of Genesis, ending *generation(s)*.

As examined above, Pauline understanding of the resurrection appears to obscure the early Judaic message proclaiming "dust to dust." Immortality, for Paul, prescribes salvation *from* and not *for* earthly *generation(s)*, thereby breaking the connection between earth and earthling. Moreover, through later Christian acceptance and appropriation of Pauline theology, this model of immortality has produced practices that abandon the stewardship of the *generation(s)* of earth, in favor of a stewardship of souls.

How might one conceive of life after death without ending ecological *generation(s)*? The following reconstructive exercise attempts to answer this question through an exploration of a "spiritual materialism," one that values heaven-earth, life-death, and earth-earthling connections of Genesis as "differentiated unities,"[25] over such Pauline dualist hierarchies as heaven/earth, spiritual/physical, and life/death. This reconceptualization of cosmology will not simply dismiss Pauline heritage. In fact, it finds great inspiration and momentum through Paul's own vision of cosmic reconciliation, while simultaneously criticizing the Pauline hierarchical valuation of immortal heaven over mortal earth.

First, an abbreviated look at physics will establish the ground for this conception of the universe. The law of conservation of mass-energy postulates that mass equals energy; that this mass-energy can neither be created nor destroyed but simply transformed from one entity into another.[26] For instance, ecology examines how "the cycling of elements has assumed equal standing with the flow of energy."[27]

The law of conservation of mass-energy provides the basis for reconstructing *immortality as the everlastingness of the universe*. The persistent quantity of matter-energy not only inspires a particular ecological and cosmological awareness of our manipulation of matter (e.g., the burden of landfills and radioactive dumps upon future generations), but it also provides fuel for understanding death. In light of how both ecology and Genesis appear to affirm reincorporation of the body through death, notions of

Immortality, for Paul, prescribes salvation from *and not* for *earthly* generation(s), thereby breaking the connection between earth and earthling. This model of immortality has produced practices that abandon the stewardship of the generation(s) of earth for a stewardship of souls.

generation(s) may truly be relevant to Christian interpretations of immortality.

Perhaps the desire for life after death stems from a human need to seek a meaningful existence beyond death. As the body decomposes, a familiar question arises: what happens to the "soul"? Studies in neuroscience and genetics have confirmed the physiological sources of human behavior; as a matter of reaction, there has been a movement to propose a conception of the soul according to a non-reductive physicalist position. In *Whatever Happened to the Soul: Scientific and Theological Portraits of Human Nature*, the soul is defined in various ways, from the individual perspective in relationship and the conscious mind to the emotional, psychological, and/or rational aspects of a person that facilitate experiences of love, transcendence, and morality.[28] While the non-reductive physicalist position roots these aspects in physiological processes, they must not be merely reduced to scientific explanation.[29]

In accordance with the non-reductive physicalist definitions of soul, the original question now may be reconsidered: what happens to the soul after death? If the soul/self is simply reabsorbed into the ecosystem, would popular culture not consider this a great loss? The law of conservation of mass-energy declares the soul/self not destroyed but converted into another form of energy. Accordingly, an organism's lifetime depth of knowledge and/or experience is lost, then, to what physicists call a "heat death."[30] What moral inspiration can be derived from such a death? Is there any hope in the meaningfulness of life without an individual resurrection?

Cosmic Christ

For Paul, the resurrection of the body is not one of individual human resurrection. Martin claims that in Paul's view, every Christian body consists of two natures: the Adamic body (earthly psychic body of flesh and blood) and the body of Christ (pneumatic body from heaven). During earthly life humans share bodily continuity with both natures—*sarx* and *pneuma*. As *sarx* can pollute the pneumatic body, the *pneuma* cleanses the body of death and/or sin.[31] In its context, Martin suggests that the "salvation of the spirit" might be otherwise conceived as the "health of the *pneuma*."[32] Paul's pneumatic resurrection body is a light, airy, luminous substance that can exist in earthly bodies, though its destination and source is heaven. This bodily continuity that humans share with the cosmos in Pauline physiology enables further speculation on the significance of bodily resurrection, not as individual, but as *cosmic* redemption.

Pauline resurrection theology calls for a cosmic redemption based upon the unity of all things in Christ (Ephesians 1:10), where God may be all in all (1 Cor 15:28). Through Christ all things were created, and in Christ all things hold together and are ultimately reconciled "whether on earth or in heaven" (Colossians 1: 14-20). Although this vision does justice to the contemporary ecological and cosmological view of a unified universe that is deeply *interconnected*, Paul's cosmic redemption clearly strays from this ecological course in the hope for a deathless creation:

> For the creation waits with eager longing for the revealing of the sons of God: for the creation was subjected to futility, not of its own will but by the will of him who subjected it in hope; because the creation itself will be set free from its bondage to decay and obtain the glorious liberty of the children of God...the redemption of our bodies.
>
> (Rom 8:19-22)

What does this redemption mean in light of Martin's argument about the pneumatic body? If Paul's resurrected body was indeed meant to be a pneumatic body, then his view of incorruptibility and the reconciliation of creation must be understood as being based upon an idea of celestial materiality. In other words, his interpretation of the resurrection will not involve *life* as we know it on earth: no crawling, walking, or slithering bodies,

no waterfalls, trees, mud, or birds. To the contrary, is his vision not that cosmic reconciliation will transform us all into stars?

Consider the possibility that the pneumatic nature of the resurrection is *not* of individuals such as ourselves, but rather a reincorporation into the pneumatic body of the celestial. *Pneuma*, for the Greeks, might signify breath or air, as well as the illumination of the stars. From contemporary cosmology, we know ourselves and the earth to be made of star dust destined for a celestial reunion. In light of Dale Martin's argument that the Pauline resurrection involves a celestial body, Paul's view can be seen as not so removed from some general assumptions of today's cosmology.

Recall the big bang theory of an increasingly expanding and cooling universe: *generations* of proto-galaxies emerged from the hydrogen and helium gas under the collapsing pull of gravitaty. The matter of the galaxies collapsed into stars, some of which exploded as supernovas, turning into black holes or dense neutron stars. These explosions flung out heavier elements, which became part of the material for the next generation of stars. Our sun, a second- or third-generation star, was formed from a cloud of rotating gas debris of earlier supernovas. Cosmologist Stephen Hawking explains how the universe came into being:

> Most of the gas in that cloud went to form the sun or got blown away, but a small amount of the heavier elements collected together to form the bodies that now orbit the sun as planets like the earth.[33]

Earth is also destined for the stars. It may be reincorporated into the celestial either by the explosion of a nearby star or by the eventual swelling of our own star, the sun.[34]

Might Paul's pneumatic body be likened to the star energy that gave birth to Earth and to which Earth is destined? Undoubtedly, Paul's conception of the cosmos was radically different from today's cosmology. His devaluation of the mortal life of terrestrial bodies contrasts with our understanding of the precious conditions under which biological life can develop. If indeed Martin is correct in suggesting that Paul considered immortal life of the pneuma as also entailing rational, cognitive, or perceptive aspects of life, then Pauline ascription of immortality to celestial bodies is scientifically implausible.[35]

Paul's breathing light of *pneuma*, if likened to the star matter composing Earth, can indeed evolve into and exist within life systems. However, nothing approaching human life could survive under the extreme conditions of stars. Additionally, stars themselves are not immortal but follow the generational pattern of creation. Individual death is not excluded even from the heavens. Once born, all stars will eventually die.

What if the pneumatic body was likened to the clouds of dust and particles moving in and out of stars and galaxies? Might, then, this everlasting matter-energy in the universe be of an immortal and incorruptible nature, in the sense that it can never be lost or destroyed, only transformed? The notion of an eternal universe has been appealing to scientists and theologians alike, but the possibility has been put on the back burner by most scientists, due to the entropic principles of the second law of thermodynamics. Paul Davies describes its effects on the cosmos:

> Everywhere we look, in every corner of the cosmos, entropy is rising irreversibly....The universe seems destined to continue crumbling, running down towards a state of thermodynamic equilibrium and maximum disorder, after which nothing further of interest will happen. Physicists call this depressing prospect 'the heat death.'[36]

Although matter-energy in an expanding universe is never lost, it is unforeseeable that the formation of new stars or galaxies, not to mention life, could occur under such extreme conditions. As the universe itself experienced a birth, like the human it will also experience death.[37] While the energy of the universe will never disappear (in this sense truly everlasting), eventually it will no longer be capable of beaming with life, galaxies, and stars, as it does now.

While this view of a dying universe is bleak, the current limitations of knowledge must be considered. Although the understanding of entropy creates this depressing apocalyptic view of the cosmic future, this same rise of entropy has given birth to the complex universe we know today. Ilya Prigogine describes the entropic creation of the cosmos:

> The universe starts with a burst of entropy (chaos) which leaves matter in an organized state. And, after this, the matter is slowly dissipating and creating in this dissipation, as a by-product, cosmological structures, life, and finally, ourselves. You see, there is so much entropy dissipated that you can use it to build something." [38]

That the same principle responsible for the organization of the universe is responsible for its demise suggests that despair is perhaps not warranted. And so, as life is dependent upon the cosmic and earthly generational processes, indebted to them for existence, should not trust be placed in the spirit of this cosmic miracle by resigning to it at death, and understanding that this dissolution is part of the "bottomless mystery that can never be reducible to current scientific hypotheses?" [39] Human construction and perception indeed has its limits. Even as the understanding of the meaning and workings of creation deepens, no one can boast of certitude about the meaning, source, and destination of all that exists.

Many find hope in scientific speculation about the possibilities for the cosmos. The notion of the everlastingness of *generation(s)* may be hopeful in light of the "many-universes" theories arising from quantum cosmology. For instance, theories of mother and child universes allow for an infinite number of generations of universes. These provide hope for the continued self-organization of life despite an eventual heat death of our universe. These theories are based on "random fluctuations" of quantum physics where on "an ultramicroscopic scale, ...all manner of bumps, wormholes, and bridges should be forming and collapsing throughout spacetime." In this view, our universe began as "an outgrowth of some larger system, which then detached itself to become an independent entity." [40] Davies continues:

> The "mother" universe which spawned ours is also continuously inflating at a fantastic rate and spewing out baby universes for all its worth. If this state of affairs is correct, it implies that "our" universe is only part of an infinite assemblage of universes, although it is self-contained now.... An interesting question is whether our universe is also capable of being mother, and producing child universes.... [41]

A many-universes theory proposed by Lee Smolin describes the existence of stars as "an essential prerequisite for the formation of life," and says that "the same conditions that encourage life also encourage the birth of other life-giving universes." [42]

As examined above, Paul's celestial resurrection parallels contemporary cosmology. As stars facilitate conditions for life, "the pneumatic body" is also responsible for life. Might the pneuma be somehow immortalized through its perpetual existence in our universe, or in its transformation from one universe to another? However, Paul's belief that immortality necessarily excludes death still remains untenable for this theory. Even with the prospect of many universes, as far as can be told, each universe would still operate with entropy and death as integral to the renewal of life.

Cosmic Christ and ecological ethics

Might Paul's "cosmic Christ" be transformable into an advocate for an environmental ethic? James Nash, in his book, *Loving Nature: Ecological Integrity and Christian Responsibility*, writes that Christian belief in cosmic reconciliation proves that the Creator values the whole of nature, and thus that Christians must imitate a God who cares for and has mercy on all creatures. [41] Nash believes the Spirit is leading us to manifestat of the New Creation. Thus, God's objective becomes our responsibility. We must pre-

pare for God's final re-creation by participating in it, by caring for and loving nature.[44] In contrast to this love for nature, Nash echoes Paul's reduction of death to evil. He explains:

> [M]ortality is the ultimate problem of morality when God is perceived as beneficent, and death is interpreted as conclusive....[A]rguments from biological necessity—death as a function of the limitation of resources and the condition of new life—do not resolve the problem. They fail to do justice to a fundamental query: Why did a good God create a biosphere in which the evil of death is necessary to avoid a greater evil of biological unsustainability?[45]

Nash's belief that death is evil seems to be in reaction to death as "conclusive." He claims that a "good" God of love, justice, and reconciliation would not "finally break all relationships." It would be ironic, he says, to be told to love one another by a God that would "snap forever all ties."[46]

The book of Genesis best demonstrates the covenant of* generation(s) *as a link between birth and death through 'earth' in the* ha-adam/ha-adama *wordplay. If this generational covenant is considered alongside the law of conservation of mass-energy, then might the everlastingness of the universe provide a meaning for death?

It is of concern that Nash sees death *only* as an end to relationships. Indeed, death assumes a painful loss of loved ones. Undoubtedly, death is too often the unfortunate consequence of human evil or accident. However, this does not make death itself evil. In addition, does not the recognition that death will terminate our relationships with loved ones intensify the meaningfulness of loving one another? Does not the act of *loving now* somehow continue after death, positively reverberating through *generation(s)*? Ecological integrity means enabling the highest quality of existence for all *generation(s)* and thus advocates experiencing love in the present.

The book of Genesis best demonstrates the covenant of *generation(s)* as a link between birth and death through 'earth' in the *ha-adam/ha-adama* wordplay. If this generational covenant is considered alongside the law of conservation of mass-energy, then might the everlastingness of the universe provide a meaning for death? We inherit this earth through countless hands, paws, and roots. The land is ancestry, composed of the generations of life.

In this view, humanity is not responsible for biological mortality. We are, however, responsible for morality, the choice of good or evil, well-being or exploitation. We have not only been blessed with the wisdom and bodies of our ancestors, but Paul's notion of inherited sin is indeed a way of reckoning and transforming our "heritage of injustice."[47] Paul's conception of inherited sin is valuable in this way. It also allows us to question the eco-injustice of his celestial immortality ideal that depreciates terrestrial nature. After the recognition of redeemable conceptions passed down from Paul (cosmic reconciliation, inherited sin), the "quasi-Gnostic cosmology"[48] of Pauline resurrection theology needs to be reconsidered. Rosemary Radford Ruether does not reserve judgment on this point. She states:

> The reconstruction of the ethical tradition must begin by a clear separation of the questions of finitude from those of sin. Finitude is not our fault, nor is escape from it within our capacities. Mature spirituality frees up from ego clinging for acceptance of the life processes of which we are inescapably a part.[49]

Although death involves the end of our more individualized soul-selves, it simultaneously affirms the physical unity of a cosmos that transforms its body/bodies over time.

If this participation in cosmic reconciliation involves eradicating death in nature, as Nash's proposal implies, then this type of stewardship is not ecologically viable. Not only is deathless life unsustainable, for we would have to stop eating, but our own cellular reproduction relies on constant renewal, involving the replacement of dead cells with new ones. It must be emphasized that many environmental problems stem from our resistence to death, including our refusal to use biodegradable materials, to allow dead trees and leaves to replenish the soil, or even to allow our own bodies to decay without toxically embalming them and burying them in sealed coffins.

Nash rightfully finds hope for the earth in cosmic reconciliation. Paul's vision of the cosmic Christ affirms a divine body unifying the cosmos in creation and re-creation. However, in support of Earth and thereby in contrast to Paul, I believe cosmic reconciliation must extend beyond Greco-Roman ideals of astral immortality that discriminate against the terrestrial, to a cosmic salvation that encourages a diverse magnitude of terrestrial life. The resurrection Spirit must not be reduced to the celestial: pneumatic breath and light must renew earthly life as well.

As mentioned earlier, death points to the importance of the present, to the significance of *moral action* physically extending indefinitely. Through the law of conservation of mass-energy, everything we do to affect or change the world stands to participate in future *generation(s)*. Moral responsibility is not about individual immortality and reserving a seat in heaven; it is about caring for and loving the born and unborn generations, about "the health of the *pneuma*" that will be passed on to them. The everlasting universe, embodied with past generations, is the ground of the present. Simultaneously, our lives, actions, and bodily inscriptions construct and become a part of the bodies of future *generation(s)*.

Conclusion

Ecology teaches us that death is essential to the *generation(s)* of life. In contrast, Pauline theology echoes a definitive perception that "[d]eath will be swallowed up in victory" (1 Cor 15:42-54). Paul's ecology may yet prove viable, though not without challenging his foundational beliefs. Dead bodies are in fact "swallowed up" in "the victory" of worms, bacteria, fungi, and the earth. Pauline theology may escape a dismissal of *generation(s)* if the body that attains imperishability is understood to be that which is resurrected in the lives of its consumers, or as the body of energy in an everlasting universe. In this sense, the matter of *generation(s)* remains part of an everlasting process, an exchange of energy in an open portal of movement between all bodies of heaven, earth, and universes.

Perhaps the restricted tree of life in Genesis justly warns against a human desire to cling to an everlasting self. Notions of an individualized immortality dangerously exclude *generation(s)*, whether through technologies that resist decomposition, beliefs that reject Earth in favor of heaven, or anthropocentrism that exalts industrial endeavors at the expense of natural ecosystems. Protecting both the tree of life and Earth from human attempts at immortality ultimately blesses all *generation(s)* of heaven and earth. It celebrates an everlasting universe.

Paul lends us a meaningful vision: "God was pleased to reconcile all things to the divine self, whether on earth or in heaven..." (Col 1:20). The resurrection is not about the individual, but about the whole. As the Gospel of Thomas proclaims:

> Jesus said, "It is I who am the light which is above them all. It is I who am the all. From me did the all come forth, and unto me did the all extend. Split a piece of wood, and I am there. Lift up the stone, and you will find me there." (77)[50]

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Endnotes:

1. Robinson, p. 138.
2. Ibid., p.132.
3. Ricklefs, p. 169.
4. Genesis 3:19.
5. 1 Corinthians 15:42-54.
6. Miller, p. 29.
7. Westermann, p. 160.
8. Kormondy, p. 18.
9. Trible, p. 78.

10. Bechtel, p.10.
11. Hengel, p. 196.
12. Ibid., p. 197.
13. Bechtel, p. 4.
14. Meyers, p. 75.
15. Ibid., p. 77.
16. Ibid.
17. Reuther, p.128.
18. Ibid.
19. Green, p. 153.
20. Martin, p. 126.
21. Ibid., p. 132.
22. Ibid.
23. Cobb.
24. Ricklefs, p. 635.
25. Bechtel, p. 10.
26. Miller, p. 23.
27. Ibid., p. 62.
28. Brown, p. 100.
29. Murphy, p. 130.
30. Davies (1983), p. 199.
31. Green, p. 172.
32. Ibid., p. 170.
33. Hawking, p. 120.
34. Davies (1983), p. 200.
35. Martin, p. 263.
36. Davies (1983), p. 199.
37. For portions of this paper relating to physics and cosmology, I am grateful for the patient and insightful consultation of Dr. Ashley Carter, Professor of Physics at Drew University.
38. Briggs, p. 148.
39. Keller.
40. Davies (1992), p. 72.
41. Ibid.
42. Ibid., p. 221.
43. Nash, p. 132-33.
44. Ibid., p. 136.
45. Ibid., p. 130.
46. Ibid., p. 131.
47. Ruether, p. 142.
48. Ibid., p. 129.
49. Ibid., p. 141.
50. Robinson, p. 135.

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Limit Conditions in an Encounter of Theology with Neuroscience

Andrew Irvine

Insofar as theology is responsible to its religious sources, it seeks to answer religious questions, such as, for Christians, "What must I do to be saved?" However, theology also involves asking whether such a question is the right one at all. This essay attempts an innovative approach to this question by investigating the intelligibility of "the soul." Much recent neurobiology suggests that, even if a defensible notion of soul can be presented, it is unclear that it would allow meaningful talk about salvation.

Introduction: the question concerning salvation

If there is something about human beings that is saveable, what is it? What makes it saveable? This "something" has been variously named; here it will be called psyche, or soul. Such radical questions are theologically vital today, because certain neuroscientific research suggests that, even if a defensible notion of soul can be presented, it is not clear that the notion would have any content allowing meaningful talk about "salvation." In light of this, this essay attempts an encounter between seemingly quite uncompromising positions: in neuroscience, eliminative materialism; and in theology, Eastern Orthodoxy. Through this test case, certain "limit conditions" of exchange between theology and neuroscience may become apparent.[1]

Theology as "interested observation"

Theology,[2] like any inquiry, is partial to its own interests. When theologians describe human being, they work with terms that help them to understand religion with relevance to *theos*, God—for example: soul, mind, choice, conscience. This terminology is not self-fulfilling prophecy, though. As the "new physics" of the twentieth century has evinced, observation is never uninterested: objects of inquiry appear different, according to different methods of inquiry. In this sense, theologians have *a priori* commitments regarding which terms best make sense of human being, and they rightly require convincing of the need to let go their commitments.

Yet, theology, like every other inquiry, ought to be conducted with interests that are "pure." So, for instance, theologians, taken as a community of disciplined inquirers seeking rational understanding of religion with respect to God, are normally adamant that they do not merely invent the objects that they study—that is, that their terms refer to things, situations, relations that are not merely linguistic. If "the soul" is a referent within theological language, then an underlying expectation is that the soul is a reality in a world in which it is referable, and that it is positively usable in other discourses, too. The minimal affirmation is that the soul have a public "persona."

W. Mark Richardson has enumerated a set of theological interests relevant to inquiry

into the soul. They constitute "a recognizable core understanding of human agency ...[that is] inalienably wedded to what is frequently called commonsense psychology."[3] Commonsense psychology (CSP, also frequently called "Folk Psychology") holds that terms such as those that theologians use refer to real features of human being. CSP trusts first-person reportage as an accurate indicator of the reality of a first person, an "I," as such. However, the accomplishments of neuroscience in this century have contributed to a fragmentation of a shared horizon that helped to validate *common*sense psychology. One problem for a present-day theologian seeking to pose the question concerning salvation, then, is that neuroscientific pictures of human being equivocate on the reality-status of the referents of CSP commitments. For example, the picture projected by eliminative materialism (EM), a neuroscientific hypothesis which rejects CSP outright in favor of experimental neurobiology, may imply that any theological claim about human being is meaningless, inasmuch as it is "inalienably wedded" to CSP. Still, theologians who intend to maintain the public reality of the soul should be willing to submit their claims alongside those of EM. As previously noted, to affirm such a degree of publicity does not imply that theological inquiry is disinterested observation; but neither should an honest test of theological claims begin by preferring a "purely" non-theological account as the norm by which to measure them. Such a maneuver, if possible, would be both unfitting and irresponsible to the engendering religious situation in which the question concerning salvation arises—a falsely humble "cultural cringe" before scientific hegemony.

Neither is the soul a body-part: it is difficult to fix for examination because that would annihilate the object of study, which is not merely a body but animated human being.

The mythic horizon of theological psyche-logy

An integrative "psyche-logy," responsive to neuroscience without ceding theological interest, is imaginable. In the first place, treated as a formal term, the "soul" symbolizes the defining aspect(s) of human being with respect to God, without necessarily specifying its character. That the soul has been important to theology in the past and less esteemed in neurobiology is not an essential characteristic of this symbol: perhaps the biochemical activity of the brain is the most religiously significant aspect of human being.[4] Secondly, whether from inherited dogmatic prejudices or from experience of human behavior, theologians have tended to image the soul as in need of salvation. Indeed, it is an image of the fundamental condition of human being (though less fundamental for current neuroscience).[5] Thirdly, the soul perhaps is not present to empirical analysis in the way the brain is. Theological interest in the soul involves a mythic framework. Even if neurobiological inquiry found the "same" soul in the "same" predicament, neurobiological modes of discourse are sufficiently different from theological modes that it would not be apparent that the same things had registered without an involved hermeneutical meta-inquiry.

Myth is discourse that images what is most valuable but least graspable about reality, and it does so indirectly and poetically.[6] It is a way of world-making. Within this horizon, one can call theological psyche-logy, without disparagement, a "soul-searching." However, myth is not the only hori-

zon for theology and, therefore, does not preclude engagement with the sciences. It is a proper theological task to inquire after the truth of the symbol of the soul. Thus, theology may be interested in science in overlapping ways. With respect to truth, does the CSP specification of the soul correspond to something real? Is it verifiable at least somewhat independently of religious and theological assertion? Is theology absolutely committed to CSP? With respect to the instrumental side of the question of salvation, if there is a soul, is it saveable, and how? Clearly, a serious engagement between theology and science necessitates sensitive checking and cross-checking. It is a hermeneutical engagement, not a wholesale demythologization or "operationalization" of theology for the sake of science (the cultural cringe). Myth refers to the empirical world, not as that world's superficial embellishment, but inasmuch as poiesis assumes materials with which to create,[7] Christian myth images this by underscoring the contingency of salvation upon actualizing choices.[8] From a theological perspective, then, one may conclude that the soul of human being is responsible being, that is, being required to choose.[9] Thus, the most important theological interest in a dialogue with neurobiology is to test whether the notions of choice and responsibility are intelligible in the biological context.

Toward integration

1. Scientific psychologies

With the rising success of scientific methods in explaining natural events in the human environment, ambitions grew to understand through explanation what human beings are in themselves. In part, these ambitions rode tandem with rejection of ecclesiastical power in society. Church power depended, some argued, on a rhetoric of an immortal soul whose everlasting fate lay in the care of the Church. But that soul was an occult notion that did not explain anything–unless the irrational subjugation of masses of people to Church power. So, a vicious ecclesial circle.[10]

This historical current stimulated attempts to explain the soul more scientifically, including modern psychoanalysis, behaviorism, and neurobiology. Yet, differences among these sciences are strong. For instance, some neurobiologists take a stand against psychoanalysis and other forms of CSP, arguing that these are no less occult then religious authority. Advocates of EM (that stand in its strongest form) expect to do away with any talk of psyche. Paul M. Churchland states:

> Eliminative materialism is the thesis that our common-sense perception of psychological phenomena constitutes a radically false theory, a theory so fundamentally defective that both the principles and the ontology of that theory will eventually be displaced, rather than smoothly reduced, by completed neuroscience. Our mutual understanding and even our introspection may then be reconstituted within the conceptual framework of completed neuroscience, a theory we may expect to be more powerful by far than the common-sense psychology it displaces, and more substantially integrated within physical science generally.[11]

Churchland's thesis has merit: after all, no psychoanalyst has ever seen an id; but his complaint is akin to cosmonaut Yuri Gagarin's boast that he did not see God while he orbited the earth. Gagarin mistakenly supposed that all theologians think God is an entity in and of the cosmos. Neither is the soul a body-part: it is difficult to fix for examination because that would annihilate the object of study, which is not merely a body but animated[12] human being. Among scientific psychologists, this is treated as an aspect of the so-called mind-body problem. EM is one of several non-dualistic, physicalist approaches to resolving the difficulty.[13]

To be true to EM, though, we should not consider it any kind of modern psychology. For its advocates, it is the way of the future: "completed" neuroscience will not

bring about any reduction of mental events to physical events, but will supersede the unwieldy and false language of mentality and psyche. The notion of "completed neuroscience" is only one of a variety of references to the *anticipated* success of EM.

The rejection of CSP works in the following way. Advocates of EM argue that CSP constitutes an empirical theory of human being. This is in contrast to other views, which either take CSP to be a normative theory,—that is, a representation of how a properly functioning human being (one whose being is in a state of well-being)" would understand him/herself—or do not consider it a theory at all but simply the reflective gleaning of the kinds of states, attitudes, decisions, beliefs, etc., that are the content of mental events.

If CSP is an empirical theory, then it may be tested in the following ways: first, for a theory truly to account for the phenomena to which it refers, it must demonstrate explanatory and predictive success. Paul Churchland acknowledges that CSP stands up reasonably well under this test.[14] For example, if I see someone having a drink of water, I can hypothesize that the reason is that they feel thirsty with a usual confirmation of my hypothesis. The feeling of thirst thus becomes an effective explanation for the observed behavior of drinking water, and not only for one experimental subject but for many. However, the extent and importance of CSP's failures should also be recognized. On this score, Churchland especially emphasizes an inability to generate knowledge about learning processes.[15] Relevant here is a second test of a theory's truth, the extent of "its coherence and continuity with fertile and well-established theories in adjacent and overlapping domains."

> If we approach *homo sapiens* from the perspective of natural history and the physical sciences, we can tell a coherent story of his constitution, development, and behavioral capacities which encompasses particle physics, atomic and molecular theory, organic chemistry, evolutionary theory, biology, physiology, and materialistic neuroscience. That story, though still radically incomplete, is already extremely powerful, outperforming...[CSP] at many points even in its own domain. And it is deliberately and self-consciously coherent with the rest of our developing world picture. In short, the greatest theoretical synthesis in the history of the human race is currently in our hands, and parts of it already provide searching descriptions and explanations of human sensory input, neural activity, and motor control.
>
> But...[CSP] is no part of this growing synthesis.[16]

Making allowance for his penchant for bathos, Churchland does have a significant claim against CSP here. At the same time, Churchland's seemingly unintentional allusion to CSP's "own domain" is a noteworthy concession. The idea of a domain reflects this essay's terminology of horizons and resolutions.

That the soul has been important to theology in the past and less esteemed in neurobiology is not an essential characteristic of this symbol: perhaps the biochemical activity of the brain is the most religiously significant aspect of human being.

A claim for the virtues of EM is made at length by Patricia Smith Churchland. Briefly, the EM resolution of the mind-brain problem is entirely in terms of the structure and biochemical activity of the brain and nervous system. This establishes relations of continuity between humans and other animals, since "neurons and their modus oper-

andi are essentially the same in all nervous systems—our neurons and the neurons of slugs, worms, and spiders share a fundamental similarity." [17] That similarity has been key to research programs of EM, since the same activities that are masked by so much complexity in human beings can be studied in environments of relatively simple organization. Although EM refuses the language of CSP, it does not affect to simplify human beings. From the level of basic cellular form and function, Smith Churchland builds up a picture of the increasing complexity and interactivity of structural organization and biochemical processes, and develops accounts of behavior, without resort to language of agency, responsibility, freedom, or choice. The challenge posed to theological description of human being by EM in its constructive program is just the adequacy of its accounts of human behavior, which prescind from introduction of CSP concepts. However, criticisms have been leveled against EM from several quarters.

Several criticisms may be made of the Churchlands' position. First, and in good CSP fashion, it may be suggested that "there are more things in heaven and earth than are dreamt of in your neuro-philosophies." Admittedly, such a claim has counted against CSP and in favor of EM. Where advocates of CSP had perhaps assumed that there could be no reduction of mental to physical, in fact neurobiologists have made extraordinary levels of knowledge available about the biochemical goings-on of human beings. Both Churchland and Smith Churchland are adamant about taking a naturalist stance. The question is, why do they restrict the character of nature to what current physical sciences, perhaps slightly extended, can make known?

A second criticism is leveled at the construal of CSP as an empirical theory that involves defining the content of CSP as a set of regulative propositions. Since observations of human behavior showed that these propositions were not obeyed, CSP must be taken to be a false theory. John Searle questions whether CSP is an empirical theory in quite the way advocates of EM pose it. "Consciousness has an ineliminable subjective ontology," he writes.[18] The "postulates" of CSP are not postulates at all; they are *experiences* and therefore exhibit subjectivity:

> [W]e do not *postulate* beliefs and desires to account for anything. We simply experience conscious beliefs and desires. Think about real-life examples. It is a hot day and you are driving a pickup truck in the desert outside of Phoenix. No air conditioning. You can't remember when you were so thirsty, and you want a cold beer so bad you could scream. Now where is the "postulation" of a desire? [19]

A third and related criticism is that EM is a theory that, for all its pretensions to monism, is really just a half a dualism. Searle again:

> Now why are they [materialists] so anxious to deny the existence of irreducible intrinsic mental phenomena? Why don't they just concede that these properties are ordinary higher-level biological properties of neurophysiological systems such as human brains?
>
> ...[A]t least part of the answer has to do with the fact that they accept the traditional Cartesian categories, and along with these categories the attendant vocabulary with its implications. I think from this point of view to grant the existence and irreducibility of mental phenomena would be equivalent to granting some kind of Cartesianism.... What I want to insist on, ceaselessly, is that one can accept the obvious facts of physics—for example, that the world is made up of physical particles in fields of force—without at the same time denying the obvious facts about our own experiences-for example, that we are all conscious and that our conscious states have quite specific *irreducible* phenomenological properties. The mistake is to suppose that these two theses are inconsistent, and that mistake derives from accepting the traditional vocabulary.[20]

Three further criticisms can be made. First, Churchland's focus on defining CSP in terms of propositional attitudes flattens language to a mere projective function.[21] But human beings also "do things with words."

The poetic indirection of myth bears this out. Linguistic action, just as one example of human activity, is accomplished very differently from the way in which biochemical processes occur. Secondly, Churchland tests CSP according to criteria of predictive success and coherence with other theories, but not according to criteria of representational correspondence to reality. Hence, there is no obligation upon him, as there is upon most theologians, to "save the appearances." Churchland's freedom here, unlike the freedom postulated by integrative theologians, seems sheerly arbitrary. And finally, Churchland's claim that CSP has stagnated for two to three thousand years might actually suggest the efficiency *and accuracy* of CSP in judging what goes on in nature, such that human beings have succeeded in dynamic engagement with changing environments for millennia.

Clearly, a serious engagement between theology and science necessitates sensitive checking and cross-checking. It is a hermeneutical engagement, not a wholesale demythologization or "operationalization" of theology for the sake of science (the cultural cringe).

II. A humble theological claim for the soul

William Seager recognizes the difficulties of EM, and the unlikelihood of a complete, reductive explanation of mind, since the kind of information necessary to provide such an explanation (explanations are "accounts of phenomena that aim at truth and which seek to make the phenomena intelligible to their target audience") is unlikely to be intelligible to any human being.[22] Seager suggests a realistic goal is *resolution*—correlating different entities and theories about them, without explicating physical causation at every point.[23] This concession, together with the final criticism made of Churchland above, raises a major preoccupation of this essay, namely, what constitutes theological humility? Theology, inasmuch as it responds to its engendering religious situation, is an articulation of the claims and the being-claimed of a Christian life-world. Proper theological humility would, thus, be committed to these various claims, even in acknowledging imperfect understanding as to the claims' performance.[24]

Orthodox theologian, John Zizioulas, insists that personhood is fundamental to human being. ("Personhood" answers to soul, psyche, in the present context.) It is Zizioulas' fundamental term for describing human being and the basis of responsibility—it is not freedom in an unconditioned sense (freedom from biological constitution, or "biological hypostasis," as Zizioulas puts it), but transcendence of the biological situation in such a way as to be responsible for it (the freedom of our biological hypostasis). Personhood contrasts with the horizon of "biological anonymity" (my term) that helps validate EM: as Patricia Smith Churchland indicates, EM succeeds, in part because all neurons share a basic structural homology. However, some questions might be asked, informed by Zizioulas' study: If the *prosopon* merely masks real biological anonymity, then why do humans "face" one another, "lose face," and so on? What is the reason for the infinite nuance of human relations? A serious account would resist biological anonymity by recognizing the powers of personhood.

Asserting the primacy of personhood is not, for Zizioulas, a disavowal of our biological constitution, but a realization of its proudest claim: that it is God's image. Simultaneously, to be human is to be so claimed. In other words, that we think of ourselves as persons is not obviously a bio-

logical necessity, and to this extent it is a free, decisive act; yet, neither is it obviously a choice for which the "I" can take credit or blame (hence, the religious intensity of debates over abortion and euthanasia). Zizioulas says that any assertion of personhood admits of being claimed by God.[25] Personhood should lead to a thankfulness, communion, *orthodoxy*, which mark a transformation of the biological hypostasis:

> The eternal survival of the person as a unique, unrepeatable and free "hypostasis," as loving and being loved, constitutes the quintessence of salvation, the bringing of the Gospel to man. In the language of the Fathers this is called "diviniza-tion" (*theosis*), which means partici-pation not in the nature or substance of God, but in his personal existence.[26]

This divinization realizes what Zizioulas will call "ecclesial hypostasis."

However, the biological constitution of the human being must be called "tragic," because it is not only a basis but a subversion of the saveability of the person. As eliminative materialists take for granted—and not they alone—humans die. The tragedy is not that we delude ourselves about our real (biological) nature, *à la* Nietzschean resentment. Rather, "it lies in [the human being's] tendency toward becoming a person through it and failing. Sin is precisely this failure. And sin is the tragic prerogative of the person alone"[27] Zizioulas presents, then, an account of the soul as emergent from, and yet somehow also preceding, the biological constitution of human being.[28] This echoes non-EM neuroscientific theories of the "emergence" or " supervenience" of personal reality from biological existence. It implies that one ought not disavow the biological constitution of human being, but look for a kind of "new birth" in which that biological hypostasis is itself constituted through the "hypostasis of ecclesial existence."[29]

Clearly, Zizioulas would only refuse a neurobiological account insofar as it takes place outside of a horizon concerned with salvation. That the horizon entails Christology is evidence of its modesty, in my view: humans express humility first and foremost, in attempting Christology (or Buddhology, or the Tao of the sage, etc.), in owning the transcendent virtue of a "perfected human":

> Christology...is the proclamation to man that his nature can be "assumed" and hypostasized in a manner free from the ontological necessity of his biological hypostasis, which, as we have seen, leads to the tragedy of individualism and death. Thanks to Christ man can henceforth himself "subsist," can affirm his existence as personal not on the basis of the immutable laws of nature, but on the basis of a relationship with God which is identified with what Christ in freedom and love possesses as Son of God with the Father.[30]

Christology is both the proclamation to and the proclamation of human being of its ownmost possibility. It is thus, Christologically, that the peculiar reciprocity of the soul's emergence and preemergence can make sense for Zizioulas. The soul's dignity and humility coincide in the biological constitution's Christological transcendence into ecclesial hypostasis.[31]

Yet, both empirical science and Christian faith have built-in resistances to the possibility of completion. There will, therefore, always be a degree of competition between the accounts while their horizons differ; but they are not mutually exclusive.

Nevertheless, we do still die; the body corrupts. Life in the Church does not prevent this. Zizioulas acknowledges this and argues:

> [W]e really need a new ontological category—not to destroy the distinction which I have made between biological and ecclesial hypostasis, but to express the relationship of these two to each other. In fact the encounter between the ecclesial and the biological hypostases [perhaps the paradigm for the present exploration] creates a paradoxical relationship in human existence. Man appears to exist in his ecclesial identity not as that which he is but as that which he *will* be; the ecclesial identity is linked with eschatology, that is, with the final outcome of his existence.[32]

As eschatological, the preemergence of the soul might be described as "advenient" (a counterpart to the neuroscientific theory of supervenience alluded to above). Zizioulas does not detail the exact character of the eschatologically completed human being—for instance, with regard to the "eternal survival of the person," whether it is "subjective" or "objective" immortality, to use terms that process theologians have long employed. The intelligibility of objective participation in life is a preliminary question of no little note in regard to Orthodox theology. But it should also be observed that Zizioulas does not speak of the biological hypostasis in its ecclesial, eschatological transformation as un-dying, but as transcending death.[33]

Conclusion

What can a theologian learn from this test case in constructing an integrative psyche-logy? This has been an unusual exchange, in that much care has been exerted to qualify theological credulity for neuroscientific findings. The point has been not so much to limit theological assertion as to understand limit conditions for the encounter of theology and neuroscience. Prime among them must be the genuine humility of frank interestedness in the inquiry. Other limit conditions have also been at least somewhat clarified, and two are noted here. First, the study of Zizioulas has hardly refuted EM (and EM would direct pointed questions to Zizioulas). However, it does challenge eliminative materialists to complete neuroscience—if they can—before the completion of human personhood takes place and the Church triumphs—if it does. Both these completions are "eschatological" in their way. Yet, both empirical science and Christian faith have built-in resistances to the possibility of completion. There will, therefore, always be a degree of competition between the accounts while their horizons differ; but they are not mutually exclusive. Each owes humility to the other. In addition, a core problem must be recognized before a serious encounter can occur, namely, to describe the relationship, if any, between emergence and preemergence, supervenience and advenience. It is still not clear that there is a way to reduce the different trajectories these concepts plot for the relation of soul and body to a final account; but the viability of a resolution involving Christological interest has been maintained by attending to Zizioulas' theological construal of biological constitution as fundamentally *personable* and, so, basic to human responsibility. These conditions, then, supply a modest proposal for a genuinely humble exchange between theological and neuroscientific inquiry.

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Endnotes:

1. Some might question the absence from this essay of a concerted critique of EM as dogmatically reductionistic. That critique is warranted. However, in this essay, I prefer to recognize the ambitions of eliminative materialists, like the Churchlands, at face value, for the sake of elucidating "limit conditions" for a mutually uncompromising encounter between theology and neuroscience. Let compromise (and/or correction) be a possible outcome, not a precondition, of the encounter.

2. Unless otherwise indicated, by "theology" and "theologian" I mean a discipline and a practitioner within Christianity.

3. Richardson, p. 351.

4. Keck addresses this possibility and, through it, conditions for the contemporary possibility of the question concerning salvation.

5. On the other hand, more than once neuroscience and related scientific/technological developments have prompted controversies about the integrity of being with well-being in the person. "Surgical"

operations on the brain, ranging from the famous accident of the railroad foreman Phineas Gage, to frontal lobotomy, demonstrated that a person's public identity and well-being somehow is implicated with the physical condition of the brain. Gage (1823-1860) survived an accident in which a tamping iron more than a meter long and weighing six kilograms was shot completely through his skull and cerebrum, although he was "no longer Gage" according to John Harlow, a doctor who attended Gage over several years. See Finger, pp. 272-273. More recently, the antidepressant, Prozac, has occasioned public controversy over just what kind of "medical miracles" we will tolerate and which should be left to God. See Kramer.

6. By poetic indirection I mean principally that myth invokes a person's or community's active participation for the realization (poiesis) of its reference structure. Myth is "merely myth," in the pejorative sense, when mythic consciousness dies. Two theologians dealing with comparable notions are Hart and Oliver.

7. A further implication, important for this essay, of the idea of poetic indirection is that there is, after all, a sense in which religion invents the soul. If theology is completely at the behest of religious life then practitioners of other kinds of inquiry would have grounds to dismiss it altogether. However, insofar as theology is autonomous with respect to religious interests, it has a comparable standing with other disciplines. Thus, if theologians find reasons for the plausibility of the soul, it is at least possible that inquirers in other disciplines may do the same.

8. Theologians have then gone various ways, more or less consonant with the mythic presentation. The doctrine of double predestination and the Social Gospel, for instance, are very different interpretations, each with serious dissonances.

9. Cf. Richardson, p .352, where he states that the first of the core theological beliefs with regard to human being is that the Creator desires a relationship with finite creatures that entails reciprocity and responsibility: "The divine-human relationship is a moral relationship, involving promises, obligations and goods to be pursued." Also cf. Barbour, pp. 360-61: "The Old Testament sees man as *rooted in nature*, sharing the finitude, creatureliness and death of all living things.... Man and beasts are equally perishable. Yet man is distinguished from this animal world by his special relationship to God. Man alone is *a responsible self* who can be addressed by God. Man, as a free purposeful agent who can respond to the demands of righteousness and justice, is made "in the image of God." Man's 'breath' or 'spirit' is not a separate entity but the animating principle of the total person, the vitality of the whole individual in his biological, mental, and emotional life."

10. See Flanagan, p. 1. He writes: "In 1663, thirteen years after his death, all of Descartes' works were put on the Index of the Roman Catholic Church, even though his writings contained two proofs for the existence of God as well as arguments for the incorporeality and immortality of the human soul. Descartes was a threat because he took the science of his day so seriously that he considered extending Galileo's mechanical conception of the physical universe to human behavior." See Robinson, p. 197, where he interprets modernity as a broader rejection of a Renaissance worldview, "the triumph of naturalism over spiritualism." Also see Zilboorg, p. 180, where he, too, identifies a sixteenth/seventeenth century shift away from "metaphysics," foreshadowing "the coupling of psychology with physics; the words *anima* and *spiritus*, so monotonously popular theretofore, began to be supplanted...." Marx's critique, more

subtle than his slogans sometimes sound. makes the point plain: "Religion is the sigh of the oppressed creature, the sentiment of a heartless world, *the soul of soulless conditions* [emphasis added]. It is the *opium* of the people." See Marx, pp. 43-4.

11. P. M. Churchland, p. 67.

12. Is this slipping the soul back in through the back door of Latin? The move is slightly more subtle; it is a suggestion that the kind of phenomena prompting any psychology *appear* to be not merely mechanical effects of the position of some kind of on-off switch. The most basic question asked by all psychologies, then (and by an integrative psyche-logy), is whether the appearance is true to reality.

13. Seager identifies five physicalist approaches. In descending order of sympathy for CSP they are: type-identity theory, psycho-functionalism, token-identity theory, psychological instrumentalism and eliminative materialism. Cf. Seager, Part 1.

14. P. M. Churchland, pp. 72-3.

15. Ibid., pp. 73-4.

16. Ibid., p. 75. Churchland's seemingly unreflected allusion to CSP's "own domain" is a noteworthy concession. The idea of a domain suits this essay's terminology of horizons and resolutions.

17. Smith Churchland, p. 36.

18. Searle, p. 56.

19. Ibid., p. 59. On this point, it seems to me that Richardson presents CSP in a more "theoretical" way than Searle thinks is realistic. I have tried to steer a path between, by reducing the stipulative claims of a theological commitment to "human being is responsible being."

20. Ibid, pp. 27-8.

21. P. M. Churchland, p. 85.

22. Seager, p. 18. Note that Seager eschews the Churchlands' zeal for "supersessionist" language in describing the goal of EM.

23. Ibid., p. 13.

24. I take this to be a crucial attitude for a theology that regards human beings as such, irrespective of their particular religious commitments. Such is the evangelical genius of Orthodox theology, as discussion to follow may indicate; I also connect this approach with the example of Valerie Saiving in her now-classic feminist theological consideration of the human situation. See Saiving, pp. 37-9.

25. See n. 6.

26. Zizioulas, pp. 49-50.

27. Ibid., p. 52.

28. On emergence as an explanation of personhood within neurobiological theory, see Cole, pp. 343-50; Richardson.

29. Zizioulas, p. 53.

30. Ibid., p. 56.

31. The Chinese tradition has been on the whole more able to image the self-sameness of human dignity and humility than have many strands of Christian tradition. For example, the Xunzi, 19.6, reads: "Heaven is able to beget the myriad things, but it cannot differentiate them. Earth can support man, but it cannot govern him. The myriad things under the canopy of heaven and all those who belong among living people depend upon the appearance of the sage, for only then is each assigned to the proper station." See Xunzi, p. 67. See also Ivanhoe.

32. Zizioulas, p. 59.

33. Ibid., pp. 64-5.

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This essay earned a First Prize.

The Full Wealth of Conviction and Cognition: Psychology's Modernist Critique of Fundamentalism in Postmodern Perspective

by Branden T. C. Miller

The author draws parallels between psychology and religious modernism as exemplified in the writings of such figures as Harry Emerson Fosdick. Miller suggests that psychological research arguing that fundamentalists are "cognitively challenged" is more reflective of psychology's unacknowledged modernist assumptions than descriptive of fundamentalists. A post-modernist recognition of psychology's bias should help redirect efforts toward understanding fundamentalists' pressing desire to preserve a particular orderly culture.

"Organized knowledge has come into open conflict with organized ignorance," Maynard Shipley declared at one peak of the controversy between Christian modernists and fundamentalists earlier this century.[1] Surely not too many periods in any nation have been completely void of religious change or unrest, but the past century on the religious frontier in America, filled with apocalyptic visions on all sides, has achieved some particularly interesting and dramatic extremes. The great force of "ignorance" to which Shipley referred was America's own homegrown brand of Christian fundamentalism, a small but vocal movement that has been at the center of (or pushing stridently along the edges through) much of the change and controversy this century. The opposing principles of modernism, whose early confidence in new fields of human knowledge ultimately became a part of the dominant cultural point of view, seem to have prevailed for some time. According to some more recent prophets of the postmodern era, however, confidence in those principles has now been largely discredited. Condemnation of fundamentalists and their methodologies has, nonetheless, remained substantially the same, even among the critically astute. Harold Bloom, for example—always as idiosyncratic as he is insightful—plays on the literal meaning of an old term, dubbing them the nation's new "Know-Nothings."[2]

A significant portion of the polemic against fundamentalism sustained after Shipley's day has come from perspectives making reference to psychology—a quintessentially modernist undertaking. By the 1960s, at least five major studies showed a negative correlation between religiosity and intelligence and/or education.[3] Despite much subsequent research and a fair amount of evidence now available to the contrary, some contemporary investigators have still felt compelled to ask whether "intelligent fundamentalist" might not be an oxymoron.[4] The question is whether these assessments are just another round of "canon fire" between two warring cultures of belief, or whether, once they are controlled for some hidden prejudices, they actually are indicative of some genuine characteristics distinguishing fundamentalists as a whole from other groups.

The feature of biblical literalism has been central to a great deal of the psychological research on fundamentalism because of its presumed association with less cognitive complexity—that is to say, with a tendency toward concrete rather than abstract thinking. It will be proposed, however, that

a better explanation for the principle of biblical literalism in fundamentalist circles may be that it is part of a socially shared cognitive style or culture of interpretation. Such a view might not only help explain fundamentalists' frequent, unacknowledged, departures from literal interpretation, it might also suggest a connection to other related features, such as their selective attention and dogmatism. From this point of view, the attraction of this movement has much less to do with intelligence than with personal inclinations such as a preference for order, an intolerance of ambiguity, or an underlying wish to preserve a certain ideological vision and way of life.

What is at risk for the fundamentalists in interpreting the Bible is not its authenticity, but the credibility of a carefully constructed absolutist dogma that is never to be challenged—not even by the Bible.

Before an evenhanded evaluation of fundamentalist beliefs can be produced from the psychological point of view, it is imperative (though seemingly unpracticed) to acknowledge the historical context of this ideologically loaded debate. Psychology is certainly an heir to modernist views of fundamentalism—a legacy of assumptions that continues to play a role in its evaluations and self-understanding. Despite this significant proviso, a brief survey of some relevant literature shows that, as a systematic approach, psychology may yet have a great deal to offer in the quest to understand fundamentalism. The observed differences in cognitive complexity probably result not from the fundamentalists' being "cognitively challenged," as many have suggested, but rather from their being culturally trained and inclined to different habits of cognition—most likely within the single domain of religion. The further suggestion is made that through a process of recognizing some of its own value judgments, psychology itself may have begun to acknowledge the limits of modernism, and may even be seen as tempering some of its previous conclusions in response to postmodern perspectives.

Modernism and the origins of fundamentalism

During the last half of the nineteenth century, under general pressure from the waxing influence of scientific methodology and from the Darwinian revolution in particular, Christianity slowly fissured into two camps: the modernists, who sought to incorporate new means of exploration and new knowledge into theology, and the fundamentalists, who resisted such change. Fundamentalism thus arose as a defense, out of a genuine concern to preserve the integrity of a faith and its tradition of values that seemed to be threatened by the increasing popularity of scientific approaches and values. By the beginning of the twentieth century, however, this movement clearly started losing ground to ascendant modernist values. It was unable to claim its place as a completely logical, empirically based approach, and began crystallizing around five dogmatically held "fundamentals" of faith:

1. The inerrancy of the Bible
2. The virgin birth
3. Christ's substitutionary atonement
4. Christ's physical resurrection
5. Christ's anticipated return to earth to reign over a thousand years of peace before Judgment.

Of these doctrines, only the second, third, and fourth are ancient Christian beliefs.[5] Together, these fundamentals defined the movement that came to be known as "fundamentalism." Number five, the "premillennialist" assumption, certainly lends a heightened sense of urgency, but it is perhaps the doctrine of the in-

errancy of the Bible that has been the flash point for the greatest controversy.

"Biblical inerrancy" and the errors of interpretation

"All Scripture is given by inspiration of God, and is profitable for doctrine, for reproof, for correction, for instruction in righteousness."[6] Often citing this sort of passage, fundamentalists revere the Bible as the sole and sufficient rule, which, therefore, has to be objectively true and plainly accessible to all. Following the developmental models of Piaget,[7] psychology has been inclined to equate this insistence on literal interpretation of the Bible with having become stuck at the "concrete" level of understanding, and possibly not having fully developed the capacity for abstract thinking.[8] In all fairness to psychology, some fundamentalist statements do, at least at first blush, lend themselves to this sort of interpretation. What is to be made, for example, of the apparent blindness to hermeneutic complexities illustrated by President Grover Cleveland's expression of frustration with biblical scholarship: "I do not want notes or criticism or explanations about authorship or origins or even cross-references. *I do not need them or understand them, and they confuse me*"?[9] And yet, if the admission is made from the beginning that reading the Bible is hard—hard for anyone—and that anyone's reading of a text is invariably reductive and personally biased in some ways, then what might ultimately be found is that there is much more behind literalism (and its shibboleth of "biblical inerrancy") than mere cognitive simplicity. At the same time, some grounds for critique of the fundamentalist approach are preserved. As Peter Gomes notes, the idea that "the Bible says what it means and means what it says...is as dangerous and wrong as it is simple and memorable."[10] Indeed, no one, not even a fundamentalist, really reads the parables of Jesus or the Song of Solomon the same way that he or she would read the Ten Commandments.

It is not, however, just biblical literalism, but also selective attention and dogmatism, that appear to possess a more exaggerated presence in fundamentalist practice and belief. In his recent volume, *The Good Book*, Gomes makes a particularly helpful contribution in his assertion that there are actually three deadly temptations in the process of biblical interpretation. First comes "literalism," the worship of the text, in which the letter is given an inappropriate superiority over the spirit. Next is "culturism," the worship of culture, in which the Bible is forced to conform to the norms of the prevailing culture. And thirdly, the worship of the Bible, whereby it is granted the place and authority of God, Gomes identifies as "bibliolatry."[11]

Other investigators would probably agree that all three of these errors are to be found peppered in among the modern manifestations of fundamentalism in various combinations and concentrations. More specifically, however, the investigation pursued here argues that culturism, rather than the popularly brandished literalism, is the primary culprit and defining impulse of fundamentalism. Rather than literalism resulting from cognitive characteristics, the inconsistency of its application as an interpretive principle suggests that when it actually does appear, it does so largely in service of cultural forces and personal needs. Such a conclusion might be of little surprise to anyone viewing the problem from a purview outside psychology's modern cultural dominance. Today, however, having given over so many modes of thought to psychological ways of thinking, scholars and others may have absorbed some of its disciplinary bias (as the study of the mind) and become prejudicially quick to embrace cognitive explanations, seeing them as primary, independent, or underlying all others.

This is not, on the other hand, to say that psychology is in any way a bootless or redundant enterprise, or that its instincts in this regard are entirely wrong. Rather it is

to suggest that there may be alternative psychological viewpoints, superior to those usually applied, that better explain why fundamentalism's particular culturist tendencies are appealing to some people, and how, exactly, individuals accomplish such Procrustean readings of the Bible in service of their social assumptions and dogmas. Indeed, everyone might have a great deal to learn from the observation of this dynamic: it entails the same processes of selective reading and misreading that allowed good Christian Americans to be slave owners until the Civil War, and to participate in segregation up until the time of Martin Luther King, Jr.[12]

The first observation to be made regarding this process is that when faced with the difficult task of having to read the Bible, the fundamentalists' need to avoid actually reading the Bible as a whole may come as an appealing relief to many. This has probably also contributed heavily to an increase in the numbers of those falling prey to Gomes' third interpretive temptation, bibliolatry. Just so, Ellen Rosenberg has remarked, "As the code words have become 'Biblical inerrancy,' the Bible itself is less read than preached, less interpreted than brandished."[13] Even more than a "protean Rorschach," as she suggests, when it comes to the Bible, the real meaning of "inerrant" today is "unread."[14] Indeed, "textual" preaching is frequently worthy of being lampooned these days because, as Gomes observes, the Bible is often merely used as "...some sort of spiritual or textual trampoline: You go into it in order to bounce off of it as far as possible, and your only purpose in returning to it was to get away from it again."[15]

Only the hierarchy of interdependent interpretive errors presented here, placing culturism at its head, also explains the inconsistencies that have exasperated so many critics and allowed psychologists to blur fundamentalism's predilections with intellectual misfortune. The reason Orthodox rabbis insist that King David was holy and did not sin, *despite* what the Bible says,[16] is that fundamentalism of all kinds demands not literal interpretation by limited minds, but rather a subscription to the absoluteness of a single preordained doctrinal point of view. What is at risk for the fundamentalists in interpreting the Bible is not its authenticity, but the credibility of a carefully constructed absolutist dogma that is never to be challenged—not even by the Bible. Intransigence is the true goal, and literalism is sometimes the means, sometimes an obstacle, and often merely a skirt to hide behind in a modernist-style culture that demands some kind of systematic approach. These important points issuing from a historically and anthropologically informed point of view will be revisited after an exploration of modernism and a survey of some of the psychological material regarding fundamentalism in light of that perspective.

Christian modernism...tended to assume that knowledge was inherently good, that progress was inevitable, that any question was answerable, and that religion and science were ultimately compatible if they were explored with rigorous, systematic thought.

Modernism and the cultural grounding of knowledge

Growing out of the Enlightenment, modernism has sometimes been defined through its association with four emergent cultural trends: a new respect for rational thinking, a strong faith in the utility of sci-

ence and philosophy to ascertain the Truth, an inchoate understanding of global pluralism, and the rise of a secular world-view. Christian modernism, as popularly exemplified by Harry Emerson Fosdick's 1922 sermon, "Shall the Fundamentalists Win?" [17] tended to assume that knowledge was inherently good, that progress was inevitable, that any question was answerable, and that religion and science were ultimately compatible if they were explored with rigorous, systematic thought.

Despite their obvious differences, in earlier parts of this century, fundamentalism and modernism had a number of characteristics in common: both took faith seriously and provided an alternative to secularism; both saw themselves as making a much needed response to the spirit of the age and tried to preserve the Bible as part of modern life; and most importantly for the purposes of this study, modernism as typified by Fosdick, and fundamentalism as originally inaugurated by Charles Hodge, were both optimistic enterprises. That is to say, while their methods and conclusions differed sharply from each other, they both believed that everything in the Bible and in the world had a pattern, and that systematic efforts can always lead to improved answers to questions and, in time, to the arrival at the Truth. "There is—quite ironically," as medical anthropologist Byron Good has said, "a close relationship between science and religious fundamentalism": both hold to the necessity and diligent pursuit of "correct" beliefs.[18] To put it another way, the hallmark of the modern secular approach, according to Clifford Geertz, is "a salvational belief in the powers of science." [19] The fact that this could not be a more apt characterization of psychology's deepest self-understanding—an understanding that has come into question in the postmodern era—should lend crucial perspective to any assessment of psychological literature concerning fundamentalism.

While it is easy to recognize the interpretive errors, inconsistencies, and biases of other systems of understanding, such as fundamentalism, "...it is difficult to avoid a strong conviction that our own system of knowledge [actually] reflects the natural order...that our own...categories are natural and 'descriptive' rather than essentially cultural and 'classificatory.'" [20] This is what Good has called anthropology's greatest contribution to twentieth-century sociology of knowledge: its insistence that all our "...human knowledge is culturally shaped and constituted in relation to distinctive forms of life and social organization." [21] These are the perceptions that have led to thepostmodern perspectivism—a recognition of the much more sweeping manner in which "truth" and understanding are shaped by one's point of view. In this epistemological milieu, psychology seems to be beginning to recognize some of the value judgments inherent to its enterprise—to recognize, that is to say, its own modernist tendencies.

Compared to the fundamentalists tested, the non-fundamentalists were shown to be more complex, open, and critical processors—but only of the information related to existential/religious issues.

Cognitive psychological views of fundamentalism: from "cognitively challenged" to culturally-shared cognitive style

Psychological studies have explored many dimensions of fundamentalism and associated it with everything from far more positive attitudes towards corporal punish ment[22] to a higher incidence of colon can-

cer.[23] More to the point, however, in addition to Goldman's work in the tradition of Piaget and the five other studies discussed by Meadow and Kahoe,[24] mentioned above, there are other studies from the past few decades that continue to lend support to the thesis that fundamentalists are, on average, of lower intellectual functioning. In two studies of *Who's Who*, published in 1969 and 1971, for example, James Dittes observed that high status in our society has for some time been correlated with religious skepticism and nonaffiliation.[25]

Beyond Zachry's hesitant conclusion[26] that an "intelligent fundamentalist" just might be a contradiction in terms, Edgington and Hutchinson[27] showed a significant correlation between fundamentalism and general lack of cognitive complexity through a paragraph completion test that specifically measured how an individual classifies and integrates information. Hunsberger and his coworkers[28] discovered that while non-fundamentalists reported coming to significant doubts about their religion by "just thinking about it," only the significant jolt of traumatic life events seemed to do the same for fundamentalists. Striking a similar chord, Malony[29] claims to have found significant differences in cognitive functioning (lower degree of cognitive flexibility, less sensitivity to the multiplicity of objects' meanings, etc.) through a scale measuring the degree to which an individual made literal, "anti-literal," and mythological interpretations of doctrinal statements.

As cumulatively persuasive as these studies may seem, there are a number of studies that do not share their conclusions. Indeed, some of the earlier developmentally-based models that equated fundamentalism with arrested cognitive development[30] have been discredited by findings that many people's religious thinking actual regresses toward literalism again after they reach maturity,[31] rather than progressing from literalism toward abstraction. Furthermore, less disparaging interpretations seem to be available for most of the recent research. While the issue does remain unresolved, until the last few years most psychological investigators seem to have overlooked the possibility that, rather than demonstrating the sort of general cognitive differences that their discipline is inclined to pursue, research results may actually be reflecting differences in cognition specific only to the domain of religion.

The critical question, then, that must be asked is this: "Is there any basis for interpreting findings as indicative of overall ability, rather than simply an elected preference in specific areas of functioning? With the possible exception of Edgington and Hutchinson's 1990 study, the answer to this question seems to be "no." Hunsberger et al.[32] cite two studies showing that, in regard to religious/existential issues (such as the existence of God and life after death), strong fundamentalists were much less cognitively complex in their thinking. In regard to non-religious issues, however, there seemed to be no difference in complexity of thought between fundamentalists and non-fundamentalists on nonreligious issues. Their subsequent study[33] produced similar results by presenting subjects with two ethical, two environmental, and two religious dilemmas. The responses they received were then analyzed for integrative complexity of thought. Compared to the fundamentalists tested, the non-fundamentalists were shown to be more complex, open, and critical processors—but *only* of the information related to existential/religious issues.

If this is in fact the case, reference-frame theory may partially explain this phenomenon: when asked to view a situation from a religious perspective, an individual could be expected to use a cognitive scheme related to his or her manner of processing biblical information. Another implication here is that methods of religious pedagogy should contribute to the shaping of cognitive processing styles. One study comparing Baptists and Roman Catholics[34] has substantiated exactly this point. In the Baptist tradi-

tion, in which individuals are encouraged to "witness" and "testify," it was found that individuals were much more likely to think about themselves and make interpretations with reference to concrete personal episodes that psychology would invariably assess as part of lower-level thinking.[35]

As McCallister[36] has recently suggested, these data help to illustrate persuasively that certain denominations do cultivate goal-related preferences for particular cognitive styles. In this same manner, fundamentalists may train each other to exhibit the literal and concrete-level thinking that has been observed, as a socially shared processing style. The question that now remains to be addressed is why this thought-shaping phenomenon should exist. Other lines of research may help explain why and how this cognitive style or preferential mode of functioning develops and maintains itself in individuals and in groups.

Fundamentalists: "cognitive misers" in a different way or to a different degree?

Psychology has catalogued many heuristics, schemas, and biases that human beings cultivate as efficient cognitive shortcuts to guide behavior while reducing mental load and reaction time.[37] Without them, the barrage of sensory data and logical and emotional contingencies would be completely immobilizing. In this sense, human beings are all, therefore, "cognitive misers"—capable only of thinking actively about a certain subset of the facts, issues, realities, and possibilities that shape their lives, some of which are chosen and some of which are not.

Considered from a sheerly pragmatic psychological point of view, religion is the most elementary story that humans tell about themselves, giving definition to the world and identifying the human purpose and proper place within it; and it surely functions as one of the most important repositories of perspectives and rules for use as mental shortcuts to guide behavior and shape understanding. While many psychologists would concede that religion in general supplies meaning to life and offers a degree of relief from some potentially overwhelming anxieties, they, along with observers from many other perspectives, are quick to suggest that there seems to be something different, something unusually extreme, going on under the wings of fundamentalism.

Exploring the ideology of political extremism, Liset and Rabb[38] may make a helpful contribution to the understanding of the fundamentalist anthem of biblical inerrancy and literalism when they target the occurrence of "simplism"—the "unambiguous ascription of single causes and remedies for multifactored phenomena." Simple answers to complex problems have always been popular, but it is significant that, according to their study, 62% of right-wing letter writers, versus 28% of the national population, hold that "the answers to our country's problems are much simpler than the experts would have us believe."[39] Seeming to parallel fundamentalism in several important ways, the mentality of simplism shuns obvious complexity and affirms that the experts—those who have specialized knowledge—are wrong, and those who do not, are right.

In their tendency towards simplism in biblical interpretation and other practices, fundamentalists are certainly cognitive misers of another degree, if not an entirely different ilk. But this issue returns to one of the principal concerns here, namely, to a further consideration of the dichotomy drawn between cognitive capability and culturally shared and selected processing styles.

The modernist/fundamentalist debate: a century-long clash of two cultures differing in cognitive style

As one psychologist recently proposed in a virtual reissue of the modernist manifesto, whereas most people tend to partition their beliefs so that religion conflicts less with the forces of reason they use to guidetheir behavior, fundamentalists often simply do not.[40] In 1922, Harry Emerson Fosdick underscored a similar point when he affirmed his belief that scripture, God,

and the world might ultimately be understood, but only through a reconciliation of religious faith with the evolving knowledge of human beings and the universe—a reconciliation necessary to keep Christianity coherent and relevant to many thoughtful Christians. As he said, "There are multitudes of reverent Christians who have been unable to keep...new knowledge in one compartment of their minds and the Christian faith in another." Most people of Fosdick's day tended "...to see...new knowledge in terms of the Christian faith and to see the Christian faith in terms of this new knowledge."[41] In contrast to the fundamentalists, who do not feel compelled to effect this sort of reconciliation, the majority of people have subscribed to modernist beliefs and see reaching such resolutions to be a basic part of understanding and, hence, of behaving properly in this world. To put it another way, a broader application of self-critical, systematic methodologies is seen as the best means of negotiating the path between human goals and human limitations as agents acting in the world.

Given the modernist assumptions of most people today, the fundamentalists' particular choice of cognitive parsimony can be very difficult to separate from a general conception of ignorance. Dealing with fundamentalism can be frustrating, and it is easy to confuse a choice not to think with an inability to think—because the results are essentially the same. One segment of the dialogue between Clarence Darrow and William Jennings Bryan at the Scopes Trial in 1925 illustrates this point very nicely; it not only elicited a confession from Bryan that he had never *chosen* to explore the claims of other religions, it also produced the following exchange:

> **Darrow:** When was the flood?
>
> **Bryan:** I would not attempt to fix the date. The date is fixed as suggested this morning [i.e., according to Bishop Usher's chronology, included in many Bibles].
>
> **Darrow:** But what do you think that the Bible itself says? Don't you know how it was arrived at?
>
> **Bryan:** I never made the calculation.
>
> **Darrow:** A calculation from what?
>
> **Bryan:** I could not say.
>
> **Darrow:** From the generations of man?
>
> **Bryan:** I would not want to say that.
>
> **Darrow:** What do you think?
>
> **Bryan:** *I do not think about things I don't think about.*
>
> **Darrow:** Do you think about things you do think about?
>
> **Bryan:** Well, sometimes.[42]

While Bryan was surely a man of intelligence and complexity, he showed neither trait when it came to his religious worldview. Darrow, consequently, made a fool of him, just as psychology has at times made a mockery of fundamentalism. As discussed above, however, dogmatism and constricted ranges of questioning are not unique to fundamentalism; they can result from any discipline's unquestioned assumptions and conceptual blind spots. Just so, one could use Thomas Kuhn's analysis of paradigm clashes in science to show that studies suggesting fundamentalism to be the result of cognitive impairment or even psychopathology are completely misinterpreted.

Ralph Hood makes just such an argument, warning that psychologists should be more wary of the influence of epistemic systems and power dynamics on the collection and interpretation of data.[43] The history of the psychological analysis of fundamentalism does indeed indicate that psychologists should heed this warning. At least as early as 1968, psychologist Paul Pruyser[44] observed that some people who are perfectly capable of thinking abstractly simply choose not to do so, under the auspices of some religions. It would seem, however, that psychology's scientific/modernist bias against fundamentalism and towards cognitive assessments have hindered its pursuit of this interpretation.

Perhaps a similar process of selective attention can be observed in the discipline's response to another extensive study carried out by Gary Maranell.[45] He explored the religious attitudes of five different groups: stu-

dents, college professors, clergy, citizens of a small Southern town, and members of a Midwestern community. There were significant educational and intellectual differences between fundamentalists and non-fundamentalists only in the Southern town sample. The fact that these differences were not found in any of the other four samples seems to have had little effect on the attitude of most subsequent psychological researchers. It seems reasonable to suggest that the Southern town sample supported the conclusions that most researchers were looking for, and the other data has simply been rationalized away or selectively ignored.

In an effort to avoid relativism, a significant difference should be noted here: whereas science does its best to recognize and correct these sorts of inconsistencies—and psychology has come a long way to recognize some of its disciplinary prejudices— fundamentalism simply attempts to defend and preserve them at all costs. Prosecuting what it claims to be a single, preordained, immutable point of view, and doing so according to a methodology at odds with almost all others applied at that same level to life in the modern West, fundamentalism frequently becomes a source of great consternation to those who encounter it. Harold Bloom surely articulates an embittered but prevalent exasperation when he says, "You can argue against dogmatism, ...but how can you argue against ignorance stubbornly proud of itself?"[46]

Maintaining the unmaintainable: subordination of logical consistency to cultural vision

Studies have shown that many fundamentalists might very well be cognitive misers in a distinctively different way;[47] but not even this finding in conjunction with the effects of paradigm-related blind spots is sufficient to explain the fundamentalist phenomenon in its entirety. A return to the above-outlined discussion of the dogmatic "culturism" is warranted. Fundamentalism might be seen as a willful, knowing neglect—a conservation in the use of reason for a reason.

Many psychological studies and theories of fundamentalism have associated it with "authoritarianism," that is to say, a very low tolerance for ambiguity and need for definite structure.[48] The fundamentalist phenomenon has also been described in terms of "self-schemas," patterns of understanding that emerge in areas that individuals care about, use to identify themselves, and inevitably become attached to. Religious self-schemas might logically result in protective cognitive narrowing on religious topics in order to preserve one's preferred identity.[49] Both of these explanations have merit and are probably major components in the appeal and preservation of fundamentalist beliefs. But a third, complementary psychological explanation that is extremely consistent with fundamentalism's historical origins may be even more encompassing: fundamentalism can be seen as a primarily culturist enterprise—an illusory attempt to resist change by clinging to a moral, social, and cosmological system that is not open to question.[50]

Although fundamentalists are surely sincere Christians, the fact that they claim to be biblical literalists while often ignoring the texts' literal sense, is convincing evidence that they have a cultural viewpoint to which they want to adhere, no matter what the Bible or any other source of knowledge has to say. Gomes' notion of culturism is,thus, clearly demonstrated by the chasm of "biblical proportions" that exists between their stated methods and their formulaic conclusions.

The characteristic aggressiveness of fundamentalists' evangelism, and the sometimes shrill desperation with which their agenda can be executed might even be said to have a "she-doth-protest-too-much" edge that is equally damning. Any number of observers have wondered if their frequently extreme tactics are not actually a defensive overcompensation for underlying uncertainties that they wish to dispel. Past studies have indeed shown that some of the most outspoken and defensive individuals are frequently the least certain of their views.[51] Similarly, although its findings are not absolutely unambiguous

one recent investigation found that in response to the question, "Do highly religious people secretly have doubts about their religion?" seventy-three percent of the most strongly fundamentalist respondents said "yes."[52]

What more can be said about how fundamentalists' beliefs are maintained in the face of adversity? As Gomes remarks, one certainly cannot preserve the conclusion that the Bible has a "clear and plain meaning" by reading it.[53] A recently published study by Hertwig, Gigerenzer, and Hoffrage[54] entitled "Reiteration Effect in Hindsight Bias" may, however, give the first coherent psychological explanation for how one might come to that conclusion simply by wanting to believe it and then repeating it or hearing it over and over again. Exposing the deeper mechanics of this phenomenon, these researchers have constructed a compelling model of how repetition of any assertion gradually increases the degree of belief in that assertion.

The shift...in psychology's perspective from seeing fundamentalism as a cognitively challenged movement to one simply subscribing to a particular cultural style of mental processing (and perhaps only of expression) is a significant step in this postmodern direction.

Another piece of the puzzle comes from cognitive dissonance theory. According to findings, once an individual commits to a particular position, he or she selectively attends to supportive pieces of information while ignoring contradictory ones.[55] Fundamentalists conform to this model since, relative to other groups, they have a much higher desire to ignore literature critical of their position. Together with observations regarding reiteration effects, this research seems to provide a persuasive explanation of how fundamentalists use self-isolation from other points of view and the repetition of carefully selected biblical verses to maintain their beliefs and shared cognitive styles.

Conclusion: final judgments in the postmodern milieu

At this point, it is important to re-emphasize that this method of willful, distorting self-exposure (as some psychologists might see it) is no more characteristic of Christianity in general than it is of every other way of life. Some rather unsympathetic branches of psychology have questioned whether many normative Christian beliefs would survive without some constriction of the range of questions allowed. Particularly in the wake of modernism's well-touted decline, however, there is little ground for asserting that conservative theology, in and of itself, is a sign of inconsistency or lack of cognitive complexity. Furthermore, one should note that, when evaluating fundamentalists, psychology might have overreached its own bounds in yet another way. In a lecture, Peter Gomes[56] cited the words attributed to Anna Barlett Warner—"Jesus loves me, this I know, for the Bible tells me so"—as an example of the proto-fundamentalists' redefinition of terms to meet the modernist challenge. Subsequently, affirmations such as these have continued to be disparaged by psychology as evidence of non-optimal or underdeveloped thinking. However, Karl Barth, one of the most learned and prolific theologians of this century, when asked late in life what was the most important thing he knew about the Christian faith, responded with these very same, simple words: "Jesus loves me, this I know, for the Bible tells me so."[57] One such concrete answer—which obviously signifies a great deal more to such a sophisticated religious thinker—is enough to call into question some of the most persuasive psychological studies. Even in its more modest assertion that it may be only

within the domain of religion that fundamentalists do not think with as much complexity, psychology has always focused on how they choose to express themselves, not necessarily on the thought that lay behind the formulation of that expression.

In his article entitled "The End of the Modern World," Diogenes Allen[58] hails the postmodern epistemological position to which our culture has drifted as an opportunity to "recover the full wealth of conviction." Arguing that the ideas upon which the modernist world-view was founded seem to have crumbled, he seizes upon the positive dimension of our current situation, casting it as one in which Christianity can be seen as fully relevant once again, intellectually and in every other respect. What others have deplored as a relativizing trend, he greets as an emancipating force liberating religious belief from the intellectual subjugation it has suffered at the hands of modernism. The shift, chronicled here, in psychology's perspective, from seeing fundamentalism as a cognitively challenged movement to one simply subscribing to a particular cultural style of mental processing (and perhaps only of expression) is a significant step in this postmodern direction.

While psychology still adheres, with good reason, to its culturally enshrined assumptions, it is at least beginning to recognize them as such—to see, for example, that more complex cognitive structure is better, and logical consistency is superior, only in relation to certain objectives that have been culturally identified as valuable. Many may be prepared to make these value judgments, seeing them not only as culturally validated but also, according to our best judgments, as somehow more attuned to "reality" as it has presented itself. Indeed, scholars must enter the fray and stake their claim somewhere. The difference is that now, with the aura of absolute Truth dispelled from modernist assumptions, modernism's claims can be recognized for what they are: value judgments that hold their place and their power with respect to a particular point of view that, while it may be provisional, most people have identified as best. In a sense, then, Harold Bloom was right to ask how one could argue against a group so defiantly proud of its ignorance. But the belittling tone of such remarks is part of a judgment issuing from a deeply contextualized alternative value system, one that leads to exasperation with this group because it vigorously promotes a different set of rules. Thus, while it may not be possible to resolve these cultural differences and their authoritative antinomies and methodological incompatibilities, at least they have been recognized as such—an important accomplishment in its own right.

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Endnotes:

1. Marsden, p. 189.
2. Bloom, p. 228.
3. Meadow and Kahoe, p. 351.
4. McCallister, p. 323.
5. Bloom, p. 224.
6. 2 Timothy 3:16.
7. See McCallister..
8. See Goldman.
9. Gomes, p. 8. Emphasis added.
10. Ibid., p. 41.
11. Ibid., p. 36.
12. Ibid., p. 51.
13. As quoted in Bloom, p. 220.

14. Ibid., p. 230.
15. Gomes (1996), p. 11.
16. Ibid., pp. 25-26.
17. Fosdick.
18. Good, p. 17.
19. Ibid., p. 182.
20. Ibid., p. 3.
21. Ibid., p. 21.
22. Wiehe, p. 173.
23. Kavan, p.1031.
24. Meadow and Kahoe, p.351.
25. Ibid., p. 354.
26. Zachry, p. 405.
27. Edgington and Hutchison, p. 47.
28. Hunsberger et al., p. 201
29. Malony, p. 296.
30. Cf., e.g., Goldman.
31. Malony, p. 305.
32. Hunsberger et al., p. 201.
33. Ibid., p. 202.
34. McCallister, p. 326.
35. Ibid., p. 326-27.
36. McCallister, p. 316.
37. See Kahneman, Slovic, and Tversky.
38. Liset and Rabb, p. 7.
39. Ibid., p. 8.
40. Alock, 1992.
41. Fosdick, p. 28.
42. Marsen, p. 187. Emphasis added.
43. Hood, p. 551.
44. Pruyser, 1968.
45. Maranell, p.247.
46. Bloom, p. 230.
47. Cacioppo, p. 1032.
48. E.g., Meadow and Kahoe; Edgington and Hutchinson.
49. McCallister, p. 325.
50. Meadow and Kahoe, p. 354.
51. Edgington and Hutchinson, p. 47.
52. Hunsberger et al., p. 211.
53. Gomes (1996), p. 31.
54. Hertwig, Gigerenzer, and Hoffrage, p.194.
55. McFarland and Warren, p.163.
56. Gomes (1997).
57. McCallister, p. 324.
58. Allen, p. 347.

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The Boston Theological Institute

The publication of this third volume of the *Journal of Faith and Science Exchange* comes at a time when the Boston Theological Institute (BTI) celebrates its first recipients of the Certificate in Science and Religion. These topics were of central interest in the founding ethos of the fourth university, or college, in the New World, Harvard College. Following the founding of the University of San Marcos in Lima and Universidad Real y Pontificia of Mexico, both in 1551, and the University of (New) Córdoba in Argentina under the Jesuits in 1609, Harvard College (1636) would reflect the deep theological division that existed in early seventeenth-century European thought.

Harvard represented a form of established Reformed polity, in distinction from other Catholic and Anglican divisions, where foundational epistemological ideas would be worked out in dependence upon Covenantal theology. The surprising thing about this theology, when viewed from the perspective of the twenty-first century, is the remarkable way in which it sought to find, through the developing sciences, a way of understanding the wisdom and ways of God beyond the smoke of theological controversy or the raging wars of religion.

Not surprisingly, this may be seen in the desire to live under God's law. For early New England, this desire was worked out for society by Nathaniel Ward, a pastor in Ipswich who also had legal training. His *Laws* would be adopted provisionally in 1641, and would receive their definitive form in 1648 as the *Book of the Laws and Liberties Concerning the Inhabitants of Massachusetts*. This work would constitute the civil counterpart of the colonial *Cambridge Platform of Church Discipline* of the same year, which adopted the catechism and formularies of the Westminster Assembly in all but polity.

How this practice was perceived was subject to much earlier debate, as the "heart" of New England was "rent" by the Antinomian Controversy (1636-38), pointedly centered on the question of the perception and practices of God's laws as expressed in God's covenants. The Antinomian Controversy was relevant to the early shaping of Harvard College. Finding the grace of law more foundational to the early colony than that of Spirit, colonial leaders followed the path charted by Thomas Shephard, rather than that of John Cotton or Anne Hutchinson. The traumatic experience that was a part of this controversy brought about New England's first pan-colonial synod and in the end would inoculate Massachusetts Puritanism for a century to come against "fanaticism" and would consequently also inhibit the successors of the Bay Colonists from letting go their acquired society-protective rationalist disposition at the time of the Great Awakening. In effect, this inoculation would protect the College from emotional extremes but also inhibit Harvard from participating in the fresh vitalities of the eighteenth-century revivals of religion, secure in its self-confident "provincial" latitudinarian rationalism.

However, apart from these debates, so formative of colony and college, the ways in which God's regular ordering of nature were to inform theological expression finds pointed visibility in the third president of Harvard College, the Reverend Dr. Leonard Hoar (1630-75). Committed to, among other things, a kind of Puritan *orare et laborare*, seen in William Law's *A Serious Call to a Devout and Holy Life* (1728), Hoar shaped his theology through the methodical logic of French humanist and Calvinist Peter Ramus (1515-72), Alexander

Richardson's "Tables", i.e., *The Logicians School-Master or, A Comment upon Ramus Logic,...Comments on grammar, notes on physics, ethics, astronomy, medicine, and optics* (London 1629; 1657), and William Ames' *Medulla theologica* (1628). In a letter to a young protégé, Hoar counsels the fixing of some form of index to knowledge incrementally gained, alluding to his own *Index Biblicus* (1668). Hoar had been able to broaden his own knowledge of the developing sciences in England, having struck up a friendship with Sir Robert Boyle (1627-91), a leading figure in the newly chartered Royal Society of London for Improving Natural Knowledge (1662). The Society included such other luminaries as Sir Isaac Newton, all of them embraced in the first scientific society in Latin Christendom, and Hoar became part of the new world of science and scholarship. He may well have surmised that if the God of the "covenant of grace" (Anne Hutchinson and the Antinomians) was increasingly difficult to discern, then perhaps the God of the "covenant of works" (Thomas Shephard and early Harvard College) might be verified in the realms of orderly nature (natural religion). In Hoar this new knowledge was integral to the transposition of his own focus of epistemology from revelation to empiricism. There was now a tradition of Reformed scholasticism of scientific inquiry with laboratory experimentation, accompanied by "utmost ratiocination," defined by René Descartes (1596-1650), in his preface to the *Discourse on Method* (1637), as the new laws of the methodologically purified mind, as a "new Bible."

Hoar was abreast of the new empiricism pioneered in his time by John Locke (1632-1704). In epistolary exchanges, he had become familiar with chemist and physician Robert Hooke (1635-1703), with botanist Robert Morison (d. 1683), who was senior physician to Charles II and the first professor of botany at Oxford, and with botanist Alexander Balaam, British resident in Tangiers. Botany, chemistry, physics, and the world of medicine were opened up to Hoar by these scientists, on whose recommendation, and then on royal command, the College of Physicians in London, on 20 January 1671, granted him the M.D. degree of Cambridge University. When the Reverend Dr. Hoar returned to New England, late in the winter of 1671/72, to take up a call to serve at the Third Church in Boston (Old South), and then to serve as President of Harvard College, his dedication to a learned ministry certainly included the kinds of instruction we celebrate with the scholarship represented in this *Journal* and with the BTI Certificate in Science and Religion.

With the publication of this volume and with the successful launching of this Certificate Program, we do well to note that the engagement between science and religion is as old as theological reflection itself. The contemporary work of Arthur Peacocke, Ian Barbour, and John Polkinghorne, to name but a few, stands in a long line of reflection on the mysteries of God and the ways of understanding and practice.

Barbara Smith-Moran, S.O.Sc., Editor
New England Center for Faith and Science Exchange

The Boston Theological Institute (BTI) and the New England Center for Faith and Science Exchange (F&SE) publish *The Journal of Faith and Science Exchange* as one of the few journals for academics and professionals doing research, development, and application at the intersection of science and religion. The editors have selected the best work of promising graduate students in this field, and present it alongside the work of more established scholars. This policy is the essence of the mission statement of the *Journal*.

This 1999 volume of the *Journal* spotlights the work of thirteen students at graduate institutions worldwide. The programs represented by these students include theology, philosophy, the history of science, psychology, and several natural science disciplines. For the first time, we publish an essay in Spanish, as originally submitted by the author, together with an English translation. All essays have been recommended for publication by the faculty members who have personally mentored the students' work. These faculty members comprise the 1999 Editorial Panel.

In addition, we include essays by four well-known and established thinkers in the field: **Imad-ad-Dean Ahmad**, **Bruce Babbitt**, **John Maxwell Kerr**, and **Arthur Peacocke**. Each has presented the paper published here as an invited speaker at conferences or lecture series sponsored by the BTI and F&SE.

Study of the interactions between religion and science was, not long ago, a rather narrow field. Reconciliation of Jewish and Christian scriptural accounts of creation and miracles with scientific laws and observations was of prime concern. Today, however, this study encompasses a dozen or more active areas, including the five topical categories treated by this year's essays.

Linguistic studies

The first three essays deal with the use of language for conveying meaning and evoking both emotion and motivation. **Marylu Bunting** proposes a formulaic description of the cosmos, its history and nature, a description that is consonant with scientific findings and that orients human beings within the cosmos. She intends this, further, to be an description with the power to motivate humility, joy, and ethical behavior toward and within the cosmos. **John Darling** demonstrates the emotive and motivational power of metaphors used by contemporary scientists when they present the results of their research to a general audience. **Maurice Lee** examines selected biological and theological accounts of language, its development and function.

Cultural context of faith and science interaction

Five essays are historical studies of the cultural context of science-religion interactions. **Imad-ad-Dean Ahmad** advocates for attitudes of moderation toward market economy, the environment, and technology, in keeping with teachings in the Qur'an, the prophetic tradition and Islamic law. **Bruce Babbitt** describes how his personal search for a non-utilitarian religious stance toward the environment led him to a new paradigm for administering environmental policy. In light of the failure of contemporary physicists to teach the general public in the United States about the excitement and importance of their research, **Margaret**

Doris analyzes some recent developments in the struggle for adequate science education in public schools. **Arthur Peacocke** engages in some "plain speaking" about traditional religious claims that must be reworked to apply to a scientific worldview, lest they make the Christian message appear to be hopelessly wedded to some bygone era. And **Matthew Stanley** shows that the appropriation of the classical arguments of Paley and Whewell for contemporary natural theology is problematic, because of the change in historical context from Enlightenment and pre-Reform England.

Theological studies

Four authors analyze the work of some prominent theologians, sometimes offering alternative ways for considering various topics. **Craig Brammer**, a psychologist, looks at Barbour's treatment of the mind-body problem and finds it incomplete and partially in error. **Ann Bersky** critiques aspects of the thought of Peacocke, Polkinghorne, and Murphy, regarding divine action in the world. **Richard Honeycutt** regrets the bias distorting many of the science-and-religion dialogues, a bias against those modes of knowing not valued by science but traditionally important to religion—namely, the intuitive and the emotional. **Noemí Pérez**, a biologist, examines some the work of Teilhard, Rahner, Schmitz-Moormann, and Ellis that explores how the Creator interacts with the evolving Creation.

Philosophical studies

Four essays delve into metaphysical concepts, with a sweep across several centuries. **Chris Doran** compares the way in which knowledge is categorized by Thomas Aquinas and by Francis Bacon, and pays special attention to Bacon's ideas concerning metaphysics. **Elora Weringer** and **Joseph Cassidy** also visit the metaphysics of Bacon, allowing him to engage in an imaginary Socratic dialogue with Whewell, Whitehead, Newton, Newman, and John Paul II. **John Maxwell Kerr** looks at concepts of time and at God's relationship to time-bound creation, and considers time's settling and unsettling effects upon those who experience it with awareness. **Jean Kim** looks at the first biblical creation story under the light of results from new branches of physics, as well as the light of non-Christian philosophical views of nature.

Ethics

And finally, **Gregory Maslowe** surveys the thought of Wilson, Mayr, and Margulis—three contemporary evolutionary biologists—concerning the evolution of ethics. In an effort to avoid the erroneous idea of a split between culture and biology, he begins to develop an evolutionary humanism.

We expect the trend toward the recognition of the subtleties of interaction between the sciences and the religions to increase, and we look forward to publishing next year's Volume IV, with essays that reflect this trend. As we have done successfully for the past two years, the Editorial Board continues in its commitment to use this ***Journal*** as a catalyst for helping to move progressive thinkers into leadership in the religious life of this country and abroad.

In Breakable Glasses: Toward a Naturalist Orientational Cosmology

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The author develops the formula, "that process that gives rise to all that exists," as a specification of the cosmos within which human life may find meaningful, ethical orientation. Her position intends to be consonant with the natural sciences and conversant with traditional orientational cosmologies of the world religions. After analyzing each of the key terms in this central formula, she provisionally proposes three ethical stances (humility, responsibility, and celebration) that might follow from orientation to the cosmos seen as "that process that gives rise to all that exists."

Introduction

Human existence is a question in search of an answer. From the first moment of self-consciousness, my existence has pushed me to ask the questions: Why do I exist?[1] and how can I make my existence meaningful? There are no obvious answers to these two questions. Human beings participate in many religions, which provide various answers, usually commensurate with, or reacting against, their originary cultural context. In the highly scientific cultural context of end-of-the-twentieth-century America, the answers of the religions no longer seem plausible, at least to me; and I am left searching by myself for an orientation to existence. What I seek is an account of my existence that would provide meaningful orientation for my own life within the context of the immense cosmos, the living earth, and the diversity of human societies. Such meaningful orientation would include ethical stances that would fruitfully relate me to other human beings and the natural world. I am searching, then, for an account of existence consonant with the natural sciences and appreciative of the natural world. I am searching for a naturalist orientational cosmology.[2]

In this essay, I attempt to develop just such a cosmology by specifying what I take to be the context of ultimate significance to be "that process that gives rise to all that exists."[3] I view this process scientifically and naturalistically. My argument will proceed through four interrelated sections that examine the expression, *that process that gives rise to all that exists*, from its beginning to its end. In these four sections, I undertake a close investigation and explication of the individual elements of this expression. In the fifth and final section, I return to the question of existence and its meaning and indicate what I see as one potential ethical framework provided by an orientation to this process.

The goal is to begin to develop a naturalist orientational cosmology that is open enough to be thoroughly integrated with the natural sciences, and evocative enough to provide for meaningful human orientation and ethical reflection. At many points, I will be able to give only the briefest and most general outlines of what a cosmology in its final form would look like. Nevertheless, I hope to begin the types of reflection that will bring me closer to its formulation, adequate not only for myself but also for all those who

find the question of existence most plausibly addressed via a naturalist perspective.

"That process..."

The first thing I specify concerning the "frame of ultimate significance" for human life is its location in a process. One might rightly ask why I have chosen to call this frame a *process* and what I mean by it. Certainly alternative formulations could be used—such as the contention of the Abrahamic traditions that ultimate significance is found within the Kingdom of God or the chosen people, or the contention of certain schools of Buddhism that it is found within *nirvana*, or the contention of certain schools of Hinduism that the "frame of ultimate significance" is Brahman. In this section, therefore, I will address the questions "Why process?" and "What process?". In response to the first, I will defend my choice of the word *process* as both concrete and vague and therefore suitable to describe the cosmos which the natural sciences represent. In response to the second, I will indicate what I take to be the natural content and rationally intelligible nature of the process.

Why process?

As a naturalist, I am searching for a term denoting the "frame of ultimate significance." I want a term that can capture what I take to be the development of the natural world as the natural sciences approximate this development. Because of the content and nature of the natural sciences themselves, I need a term that is concrete and vague. It must be concrete in the sense of being temporal, historical, and denoting a unitary process constituted by plurality. It must be vague in the sense of allowing for change and amendment in the natural sciences themselves. In this section, I will argue that *process* is just such a concrete and vague term.

In regard to the concrete, *process* can have the sense of temporality, historicity, and unity encompassing plurality. I need a term implying temporality and historicity, because science reveals a spatiotemporal cosmos whose currently observed character is a result of historical interactions and development. *Process* is a good candidate because it can imply temporal phenomena as seen in the derivative words procession and proceed. One element follows another temporally in a process or in a procession, like the bride and her bridesmaids in procession down the aisle at a wedding, or like a mother duck and her ducklings in their procession from their nest to the pond or stream, or as a reaction proceeds after the combination of two chemicals.

Moreover, *process* can imply historical phenomena in the sense that anything that proceeds temporally can be said to have both a past and future without which it would not be what it is. A recombinant gene therapy to aid in glycolysis would not arise without the historical process of experimentation as part of its development. Similarly the oxygen and nitrogen mainstays of Earth's atmosphere would not have arisen without some historical proceeding of a series of reactions to bond the requisite particles together. In this sense, saying that *process* is a term implying temporality is also to say that it implies historicity.

Process can also imply unity in the context of plurality. I need a term denoting "unity in the context of plurality," because the natural sciences have come to understand, and attempts to approximate in its developing understandings, a cosmos that issues from the singularity of the Big Bang. The cosmos is unitary in that sense; at the same time, it is plural in that many different, though related, entities—from subatomic particles to supernovae—have arisen as a result of the Big Bang.[4] The cosmos arising from the Big Bang is composed of many entities and processes, but one can ultimately refer it, in its entirety, back to the one process of expansion and cooling arising from the Big Bang.

This phenomenon of unity in the context of plurality may be seen at other levels

of the cosmic process as well. In biology, for example, in Margulis' account of evolution,[5] increased complexity in organisms can arise both as a result of the combination of less complex organisms, and also as a result of the prolonged separation of equally complex organisms. While evolution denotes the entire stretch of such combination and divergence, it also denotes the pluriform occasions of combination and divergence without which evolution would not arise. Moreover, this example illustrates that a unitary process can be constituted with regard both to a plurality of entities and to a plurality of processes—all within the one unitary process.

Since it can bear the meaning of all of these senses of unity in the context of plurality, as well as of temporality and historicity, *process* is a good candidate for the term denoting the "frame of ultimate significance." It can take on the concrete dimensions of the cosmos that scientific experiment and approximation represent.

While attempting to understand and orient oneself within this natural and rationally intelligible process, one is oneself always already both natural and rational, and always already within the very process that one seeks to understand and orient oneself within.

Nevertheless, in their own development, the sciences also suggest the need for a term that is open to new information and amendment. Big Bang theory and evolutionary biology are just two examples of areas in which scientists have significantly developed and changed their views, as growing quantities of data emerged after the introduction of the theory.[6] Scientists continue to amend both theories as they integrate yet more information. The case is the same throughout the sciences. The account of nature put forward by the natural sciences has also undergone, and continues to undergo, amendment as a result of more adequate or different metaphorical paradigms.

My central denoting term thus needs to be similarly open to new information and amendment. *Process* can bear this burden because it does not depend on any specific interpretation that the natural sciences propose, but rather it relies on the overall flow of the sciences' representation of the cosmos. The choice of *process*, therefore, is not founded so much on the individual details, as on the consensus of the natural sciences that the cosmos is a spatiotemporal phenomenon that changes as it expands spatially and temporally. *Process* is, therefore, both specific enough and open enough to be heuristically valuable with regard to human meaning and ethics, as I argue below.[7]

What process?

If I am talking about a process that is suggested and studied in the natural sciences, then I am talking about a process that is natural in content and rationally intelligible in character. This section is an exploration of what it means to say that the process is natural and rationally intelligible, so as to specify further this key orientational term.

The content of the process is natural in the most obvious sense of implying no supernatural entity that exists external to the process and intervenes in the flow of the process. Yet this is not a positive statement about what is natural. Rather, I take the term *natural* positively to include all those entities and processes, animate and inanimate, material and emergent from material, that represent potential subjects of study in all

the natural sciences, or that are the products (such as human culture or art) of entities and processes included among those studied in the sciences. To say that the content of the process is natural is to use a shorthand for all of these entities, processes, and their products. By saying that the process is natural, I do not mean to say at any point that there is a process separate from these natural entities and processes. There is not a reified or hypostatized process here—no *elan vital*, but simply a heuristic term for denoting the entirety of the natural entities and processes without which we could not and would not be speaking about a natural process. There is no natural process without the natural entities and processes that constitute it.

Since it is natural, the process is also, in principle, rationally intelligible. If the entities and processes exhibiting the regularities that the sciences discern constitute the entirety of the process, then none should, in principle, be beyond human rationality. The process is rationally intelligible only in principle, though, since human rationality faces the dual limits of human perception and of the character of the phenomena observed. A good example is the current status of Super String Theory.[8] It proposes to explain the fundamental quantum compositional elements of the universe via "strings" of Planck length (10^{-33} centimeters) that vibrate at various frequencies and thus give elementary particle/waves their character. Since the human ability to perceive entities is limited to sizes much larger than Planck length, the theory cannot be tested directly. The limits of human perception impose corresponding limits on rational understanding—at least as we would want it to be rigorously verified through observation. Even if humans could perceive Planck-length entities, however, the nature of these entities as both very small and very fast (as quantum mechanics shows) would mean that scientists could not simultaneously give both the position and the velocity of these entities and, therefore, could not have the full knowledge necessary to predict future events. Quantum mechanics could thus only provide an account of the probability of a string existing at a certain position and velocity. (I return to this topic below.)

So while the process is, in principle, rationally intelligible, there may be practical limits to the human ability to know it completely. Still, these limitations come at the very boundaries of knowledge and not in the understanding of the broad outlines of the process that are important when seeking orientation for human lives. Moreover, it must always be borne in mind that while attempting to understand and orient oneself within this natural and rationally intelligible process, one is oneself always already both natural and rational, and always already within the very process that one seeks to understand and orient oneself within.[9]

"That gives rise to..."

Saying that one finds oneself within a natural and rationally intelligible process is not, however, to say what occurs within that process—although certainly in specifying it as natural and rationally intelligible, one indicates something of what is included in the form of Big Bang cosmology and evolutionary theory. In this section, I will further specify the process as "giving rise to" all that exists. I will argue for this formulation both negatively with regard to what I see as the weaknesses of alternative formulations, and positively with regard to the strengths of my proposed formulation, *gives rise to*.

Alternative formulations

In the Western Christian tradition in which I grew up, *that process that gives rise to all that exists* is usually described in the language of creation and creativity, entailing agency and purpose. Such descriptions often make an analogy between human acts of creativity and the initial act of creativity that results in the grand cosmic creation. Alternatively, and with even more emphasis on purposive agency, some descriptions draw out the analogy of human designing to the

notion of a designer of cosmic clockwork. In my naturalist perspective, these formulations present several difficulties, specifically, their emphasis on purposive agency, their implicitly static view, and their anthropomorphism. The question is whether such attributes as purposive agency, the unfolding of a static (once for all time) design or creation, and human-like activities are appropriate to the natural and rationally intelligible process within which I am attempting to formulate a meaningful and ethically orientational cosmology.

Formulations implying a unitary purposive agency that creates or designs the process present me with particular difficulty. Within my naturalist perspective grounded in the natural sciences, the first difficulty is that they violate the chain of relationality and causality either in a proposed non-temporal initial act of the agent, or in the proposed continual action of the agent. This violation then results in a violation in the intelligibility of the process, for if supernatural causation prevails, it need not be intelligible to human rationality. Indeed, the claim that the ways of the world are inscrutable and incomprehensible often accompanies the assertion of a unitary agency and the formulation of the existence of the cosmos as a creation. Such claims are usually not made in the case of a formulation of the cosmos as design. But causal regularity and intelligibility are not the only factors that make these agential formulations difficult to support from a naturalist perspective.

The character of the process itself raises difficulties for creation or design metaphors. While some descriptions view the cosmos as a creation or design with a purposive intent, usually for the benefit of humankind, from all that the natural sciences seem to suggest, the cosmos does not itself display a unified purpose, let alone one that favors human beings. That the process is purposive is simply not borne out by scientific understanding. Human beings, for all the interest they hold as a self-aware and agential species, are not specially valued by the cosmos as the "crown" of the process. Rather, in the account the natural sciences give, human beings are one more part of the process (which is, after all, not separate from its parts). Moreover, for a naturalist perspective, to predicate of the process a preference for individual entities within it seems untenable without reifying the process itself and predicating a purpose of the process that the sciences do not support.

A second difficulty with creation and design formulations is the relatively static view that they present of the cosmos. If the cosmos is either created or designed, it is a once-for-all-time kind of operation. One can go in two directions with creation and design, yet both turn out with a fairly static view. On the one hand, one can say that the creator or designer created or designed everything as it currently is. All that is, is as it is, by the intention and the single creative action of the creator. Most have abandoned this claim, however, given that both Big Bang cosmology and evolutionary theory suggest temporal development and change. On the other hand, one can say that the creator or designer created or designed the cosmos via these natural operations so that it would turn out exactly as it has. This view, however, seems to deny meaningful development by turning the process into a more gradual version of the first contention, that all exists as it is by the intention and creative action of the Creator. While this second option is not falsifiable, its heuristic usefulness is questionable. If the emergence of all that exists can be understood via a scientific framework, why add another hypothesis that carries with it the additional difficulties of positing a supernatural agential being?[10]

A third set of difficulties arises from formulations relying on creation and design metaphors; these relate to anthropomorphism. A certain amount of anthropomorphism may be unavoidable, because we try to understand the cosmos via what we know best: ourselves. The question is whether

some forms of anthropomorphism are more appropriate than others, given the character of nature that the sciences represent in their best approximations. Certainly, given the two previous arguments, unified agency and creativity or design toward a purpose seem to be inappropriate forms of anthropomorphism. Similarly, other forms of anthropomorphism that often accompany creation and design metaphors, such as the attribution of gender, emotive expression, and independent rational intelligence to the creator or designer, seem inappropriate as predicates of the process when viewed naturally.

Other human characteristics, such as emergence, relationality, and finitude, might be appropriate predicates for at least parts of the process, and relationality might be appropriate for the process as whole. In the case of emergence, relationality, and finitude, however, I have to wonder whether their applicability stems from the fact that humans are parts of the process, rather than from the fact that the process exhibits human-like characteristics. In the end, metaphors of creation and design entangle me in too many forms of anthropomorphism that seem inappropriate for me to deem these formulations as the most heuristically useful in orienting myself to the process.

In the end, metaphors of creation and design entangle me in too many forms of anthropomorphism that seem inappropriate for me to deem these formulations as the most heuristically useful in orienting myself to the process.

Strengths of "gives rise to..."

In contrast to these difficulties with agential, static, and inappropriately anthropomorphic formulations, the formulation of the "frame of ultimate significance" as *that process that gives rise to all that exists* has notable virtues—most especially in avoiding the very difficulties into which creation and design metaphors fall. First, *gives rise to* does not imply a unitary purposive agent such as a creator or a designer, but rather allows one to take into account the plurality of causal relationships within the process. It is this plurality that constitutes the process itself. There is no process separate from the plurality. Indeed, even such things as the non-local influences hypothesized in some versions of quantum mechanics can be considered as potentially efficacious in *that process giving rise to all that exists.* In this regard, like *process*, *gives rise to* can be both concrete in its acknowledgment of natural causal relationships, and also sufficiently vague to allow for the development and refinement of human knowledge.[11]

Secondly, *gives rise to* has the virtue of conveying the kind of temporal dynamism that the natural sciences observe in the cosmos. The process qua process continually gives rise to all that exists, and the flip side is that the process also includes the constant passing away of entities. Also within the framework of dynamism, *gives rise to* can convey a sense of continuity and interrelationship between past, present, and future events. Such continuity and interrelationship is fundamental to the pictures that the natural sciences give of the cosmos in which nothing exists that is not related to other entities in all temporal modes.

Thirdly, *gives rise to* is not immediately anthropomorphic but can be considered as "nature-morphic." It is precisely the character of natural phenomena, I would

argue, that they arise as a result of other phenomena, and that they give rise to still other phenomena through their existence. As chaos theory and Bell's theorem suggest, every existent entity is influencing the existence of other existent entities at every possible moment. Chaos theory shows that one cannot predict how influences will combine to affect the future.[12] And Bell's theorem shows that a quantum entity cannot be completely isolated from influences extraneous to those imposed in a laboratory experiment.[13]

In light, then, of both the difficulties of traditional formulations, such as creation and design, and the considerable strengths of *gives rise to*, naturalistically viewed, I conclude that *gives rise to* is the more adequate descriptor of what occurs within the process that I propose as the "frame of ultimate significance" for human orientational meaning and ethical systems. It is non-agential and non-purposive, allows for the complexity of natural causation and expresses the dynamism and change of the natural world. Moreover, *gives rise to*, like *process*, is open to changes and amendments that may occur subsequently in the natural sciences.

"All..."

From what I have argued so far, an entire section on the definition of *all* might seem odd; but in the context of previous human meaning and ethical systems, such as the world religions, the question of whether the process gives rise to *all* that exists becomes a pressing issue. Some previous religious orientational systems have posited separate origins for different aspects of the cosmos[14]—such as the famous Manichean formulation of a strict dualism of matter and spirit, evil and good; or the Greek formulation of the One and the Demiurge, the first identified with the Good and the second identified with the creation of the natural world and the root of evil therein. I will argue both negatively and positively for my contention that the process gives rise to *all* that exists. In the first part, I will address alternative formulations; and in the second I will argue for the strengths of my own proposal.

Alternatives to "all"

Dichotomies arise in the Western tradition[15] especially when philosophers and theologians address the question of evil and the question of human uniqueness. In the case of the former, some have proposed two different sets of originary processes, one for good and one for evil. In the latter case, some have proposed a graduated scale of existence in which the immaterial has a greater existence than the material. These graduated scales interpret the material as having less being and goodness than the immaterial. In this section, I will look at the difficulties of these two formulations in the context of my naturalist orientation.

The question of evil presents a particularly difficult human problem, especially for Western religious traditions, which view the deity as the good Creator of humankind. If the Creator is good, some in these traditions have argued that the deity cannot then be the source of the evil in the world. There must therefore be two sources: God and the devil, or God and a demiurge that creates matter. With such formulations in place, the religious objective becomes a flight from the material world with an escape to the immaterial good deity. The on-going activities of the world become a battleground for the two hypothesized warring deities or forces.

My naturalist perspective has obvious difficulties with such formulations, not only because of their positing of agents external to the process (as discussed above), but also because they fragment the cosmos into two separate and clashing processes. Given that the natural sciences represent the cosmos as a unified process, such dichotomies seem to have no place in a naturalist perspective. Just the same, because of their prominence, I feel I must stipulate that the

process gives rise to *all* that exists and address the difficulty that produces the dichotomy in the first place. In the next section, I will argue for a naturalist account of evil in the context of the *all* to which the process gives rise.

The belief in human uniqueness has also been the occasion for a fragmented view of the cosmos. When considering human uniqueness, the divide between matter and spirit is usually at the root of the fragmentation in the Western tradition. Many authors propose that it is the immaterial soul that separates humans from everything else that exists. Following the idea of the *imago dei* in the book of Genesis, they identify the soul or consciousness with God's image in humankind, who must then turn away from the lesser things of the material world and toward the more thoroughly good things of the immaterial, spiritual world.

There is no need to introduce a dichotomy or fragmentation into the description of the cosmos to account for the human perception of evil; rather, evil as a concept can be referred back to human beings and their values, and both can be seen as arising within the process.

This position again presents several difficulties to my naturalist perspective. Foremost among these is its separation of the world into material and spiritual, with the spiritual being closer to the source of the world and the material being either a degraded creation of the deity or a creation of another god or demiurge. As a naturalist, I view what some religions have called the human soul (consciousness or mind) as emergent from the body and inseparable from it. Moreover, there is no reason in evolutionary theory to view the human species as particularly unique, regarding special valuation or goodness, but rather only as different, in respect to all the characteristics that distinguish it from the other species. This difference does not place humankind outside material processes or above other material entities; rather, in the emergence of consciousness from matter, evolutionary theory places humans squarely within the natural world as a product of billions of years of the development of life-forms prior to the evolution of *Homo sapiens*. Moreover, biologist Ernst Mayr has argued that humans cannot claim consciousness uniquely, since "traces of consciousness are found even among invertebrates and perhaps protozoans."[16] In the next section, I will provide what I see as the beginning of a naturalist understanding of human difference and its inclusion in *all* to which the process gives rise.

"All" in relation to evil and human uniqueness

When I say that the process gives rise to *all* that exists, I truly mean *all* from whatever perspective or scale one wants to look at the cosmos— from quanta, chemicals, and minerals, to bacteria, plants, and multicellular animals, to planets, supernovae, and dark matter—and also including things that humans have not yet discovered—and may never discover. Moreover, that each of these is part of the process is the relational fact that allows for continuity between and among these entities and the various sciences that study them. As a naturalist, I hold that all scales of existence are meaningfully related, while at the same time I admit that philosophers and scientists have not yet thoroughly formulated the details of this relation.[17] Since I am not only speculating about

the nature of the process that gives rise to the cosmos but also hope to provide for human meaning and ethics, I will at this juncture provide a summary of what I take to be an naturalist account of evil and human uniqueness.

From my naturalist perspective, the concept of evil is just this: a human concept relating to the humanly perceived deleterious effects that human actions and other natural phenomenon have on human lives and on the rest of the natural world. There is no independent force of evil, nor is there any entity that is evil. Rather, there are human actions and other natural phenomena that negatively impact—in the sense of inhibiting the flourishing of—human beings and the rest of the natural world.[18] Since the human species arose via evolution within the process, human values can be seen as internal to the process. The key distinction is that these are values that human beings produce and overlay on other phenomena. It is not the phenomena that have or possess these values intrinsically. In this sense, there is no need to introduce a dichotomy or fragmentation into the description of the cosmos to account for the human perception of evil; rather, evil as a concept can be referred back to human beings and their values, and both can be seen as arising within the process.

The case with regard to human uniqueness is similar. Human beings are only unique in the sense that they are different from other natural entities. This species is just as natural, just as existent, and just as much a part of the process as other natural entities. Just as human values (including the concept of evil) arose within the process via evolution, so too do the differences between human and other natural entities. Moreover, consciousness, that human feature usually singled out as unique, is one more of the features that arise within the process, and not something provided by an external deity or world spirit. As Mayr writes, "The human mind seems to have been the ultimate product of a concatenation of numerous miniemergences, in both our primate and hominid ancestors."[19] While the natural sciences do not yet fully understand the emergence of human consciousness, they do not cast doubt on this emergence, but continue to provide good evidence for the naturalist belief that even something like consciousness that seems immaterial is in fact an emergent property of complex material systems.[20]

Thus, while some human orienting systems have found it necessary to fragment the cosmos in order to give accounts of evil or human uniqueness, the unity of the cosmos can be maintained, and evil and human uniqueness can continue to be accounted for within a naturalist framework. The *all* to which the process gives rise includes even these seeming intangibles of human creation, since humans themselves are among those entities comprising the all to which the process gives rise.

"That exists..."

I have arrived at this point in explicating my proposal that the "frame of ultimate significance" is *the process that gives rise to all that exists*, assuming the actual existence of the process, the all, and its arising. Many debates rage—both those internal to the sciences in the philosophy of science, and those external to the sciences in philosophy and religion in general—about how existence is to be understood. In this section, I will explore what I take *exist* to mean in light of philosophical and scientific considerations.

Philosophical considerations

Along with many in the sciences, I consider critical realism the most plausible stance toward the question of what it means to exist and to have knowledge of things that exist. This philosophy was developed in response to the epistemological questions of science, such as, Does science really produce knowledge about the world, or does it simply construct internally coherent linguistic systems that have the pragmatic value of

producing repeatable phenomenon? According to Delaney, critical realism holds

> that the primary object of knowledge is the independent physical world, and that what is immediately present to consciousness is not the physical object as such, but some corresponding mental state broadly construed.[21]

Critical realism thus assumes the existence of the physical world beyond human perception of it and takes on the challenge of finding and testing ways of representing this world to human consciousness.

In recognizing that the physical is represented in consciousness and not directly present to it, critical realism recognizes the place of the observer in all statements about what exists. Perhaps it simply draws on Descartes' argument that established the doubting individual and moved outward to affirm the world, but it goes beyond Decartes to say that the way in which the observer perceives the world in his or her representation will change how he or she understands the world to exist. Still, these representations can be tested, and in that way a better, more closely approximate, representation can be found. The fitness of approximations can be judged by whether they provide a necessary framework not only for repeatable and successful[22] experiments, but also for prediction in future experiments and for the production of these experiments and research regimes themselves. Philosophically, then, critical realism predicates existence of both the observer and the physical world observed.

Scientific considerations: scale, duration, and quanta

Yet the question remains as to how to construe the existence of individuals within the process, and how to differentiate these individuals qua individuals. With regard to scientific considerations of the question of existence, I will break the question of existence down into the questions arising in the context of scale, duration, and quantum mechanics—since in a spatiotemporal process these are the key dimensions that determine whether the question of an entity's existence can be considered concretely. (The existence of non-spatiotemporal entities can be considered, but only in the abstract logic that explains why the hypothesis of an agential God external to the spatiotemporal universe is a non-falsifiable hypothesis.)

With regard to scale, the question of an individual's existence is particularly complicated, because one can view any object of human perception from many different scales, from the subatomic level to the level of organism. If one knows every molecule that makes up a person, does one know the person? Not entirely. If one knows that water is made up of two hydrogen molecules and one of oxygen, does one know that water exists in three phases? No. Conversely, if one has just slipped and fallen on a patch of ice, does knowing the molecular structure of water give any relevant knowledge about the cause of one's newly broken ankle? No. Each level of scale tells something, while none is exhaustive of the whole. The key thing is to determine which is the relevant level of scale, given the operation of understanding with which one is concerned.

At the same time, I would submit that there are unifying levels, primarily levels of organization, that can help to identify the existence of individuals. Subsidiary parts of an entity may change, but as long as the organizational structure remains, the individual—whether it be a molecule or an elephant—can be said to exist. For example, the existence of my body can be investigated at numerous levels, including molecular, cellular, psychological, medical, and even artistic; yet what makes it my body is the particular organization of its many elements and systems, together in a particular place.

In stipulating this, however, immediately the question of duration arises. To say I exist at a particular place is to say I exist at a particular time—I am a spacetime entity. Moreover, I have a supervening organization. My organization continues in both space and time. No other individual can occupy the

exact "placetime" (that is, place and time in spacetime) that I inhabit, although some individuals, such as bacteria inside and on the surface of my body, do inhabit places within and on me. Moreover, with regard to existence as endurance, there are two perspectives that are important to take into account: the proximate and the ultimate.

Proximately, certain entities endure with certain organizations, even though some components change or pass away. The existence of the individual is not contingent on any one of its component, but on the organization; and the entity no longer exists when the organization breaks down. Ultimately though, given the connection of all spacetime to the Big Bang, it could be said that everything has existed since the Big Bang, though in changing organizational make-up. Every entity that can be distinguished proximately by its organization is also ultimately made up of components that comprise the larger organizational framework, spacetime. Some thinkers draw on just this analysis when they say that each person is made up of star dust. This is a statement about the ultimate level of composition in which all that exists can be traced back to the Big Bang.

Consciousness, that human feature usually singled out as unique, is one more of the features that arise within the process, and not something provided by an external deity or world spirit.

This statement brings to the fore the two key problematics of existence found within science: quantum indeterminacy and quantum non-locality. The problem of quantum indeterminacy finds its systematic expression in the theory of Werner Heisenberg. He showed that a particle's position and momentum (or velocity) are related, such that the product of the uncertainty of the position, Δx, and the uncertainty of the momentum, Δp, is greater than the Planck constant, h:

$$\Delta x \, \Delta p > h.$$

This means that one cannot make a precise measurement of position and momentum simultaneously.[23] The more precisely one measures the position at a given time, the less precisely one can measure the velocity, and vise versa. One can, therefore, only produce a probability of any particular particle occurring at a particular position with a particular momentum (or velocity).

In itself, some do not find this principle disturbing. Indeed, many scientists do not find it disturbing at all but see it simply as a feature of small, fast, and brief entities, as well as of the observational techniques. Others, however, feel that this uncertainty entails a fundamentally worrying instability in the natural world, since at a quantum level entities seem to remain probable rather than actual until they are observed. As Herbert writes:

> Running parallel to the quantum facts, quantum theory represents unmeasured quons as waves and measured quons as particles. Furthermore it regards these unmeasured waves not as real waves but merely as waves of probability.[24]

So, on the one hand, one could see the uncertainty principle as describing simply a state of experimental affairs, while, on the other hand, one could say that the principle implies that existence is in some sense dependent upon observation itself. As a critical realist, I tend to believe that the former is more the case than the latter; but that is not to say that either is the more plausibly held. Certainly there is something peculiar about observation. At least it is true to say that, when a scientist measures the position of a particle, it exists relative to him

or her only in that position (since special relativity shows that position is always with reference to the position of something or someone else); but whether it is true that the particle only exists if measured is debatable.

Since even the best informed scientists have not reached a consensus about the implications, either epistemological or ontological, of quantum uncertainty, as a non-scientist I want only to note them and to say that a full and scientifically rigorous orientational cosmology would want to take full account of them. Moreover, one implication that can surely be drawn, one that is particularly relevant for my orientational cosmology, is that the entities that make up the world on the quantum level and at greater levels of scale are intimately and inextricably interrelated. This is the case whether one takes Heisenberg's principle as epistemological, ontological, or both.

Quantum non-locality is similar in nature to quantum indeterminacy. Its implications can be regarded as epistemological, ontological, or both; regardless, in the end it suggests an intimate relationality. Quantum non-locality, as I understand it, basically refers to the fact that no matter how one attempts to isolate a quantum particle/wave, it always displays a certain amount of disturbance resulting from forces that one cannot fully specify. Moreover, it says that these forces are non-local, and that "no local reality can explain the type of world we live in."[25] Some physicists, among them David Bohm and Erwin Schrödinger, argue that all quanta are inextricably related beyond the speed of light via previous "phase entanglement" during their close proximity at or near the Big Bang. Their conclusion, as Herbert writes, is:

> Bell's theorem shows that the holistic grammar of quantum formalism reflects the inseparable nature of reality itself. Beneath phenomena, the world is a seamless whole.[26]

Others argue that non-locality is an epistemological issue relating, as does Heisenberg's uncertainty principle, to the very nature of quanta as very small, very brief, and very fast—and therefore more susceptible to perturbation than are gross entities of ordinary human perception, such as rocks or hippopotami.

As a non-scientist, I am certainly not going to resolve this debate. Still, like quantum uncertainty, in either interpretation, quantum non-locality says something important about the cosmos to which I seek to be related: the cosmos is, on a fundamental level, highly relational. No entity can be fully specified without describing its relation to other entities; and thus all existent entities, to one degree or another, play a crucial role in constituting (either definitionally or ontologically or both) the existence of other entities.

In summary, then, within the context of scientific considerations, *exist* means several things. In the first place, from a critical realist position *exist* means that the physical world *is*, with or without human perception, but that human beings are able to have knowledge of its representation in their consciousness through scientific and philosophical approximations. Secondly, with regard to scale, *exist* means that an entity can be viewed from many perspectives. I argue, however, that one can discern an organizational level that distinguishes one entity from another. A third understanding of *exist* may be found in the context of duration, because the organizational level of the individual supervenes precisely because it endures, while all of the subsidiary elements may change. When the organization breaks down, the entity no longer exists, and the elements that once comprised the entity will be incorporated into the organizational structures of other composite entities. In this sense, the elements of the process exist both proximately as individuals, and ultimately as parts of the overall process arising from the Big Bang. Finally, at the quantum level two different features of quanta problematize the notion of existence. Quantum indeterminacy may indicate an intrinsic relation between existence and observation;

it may indicate an extrinsic (to existence) but unavoidable influence of the observer on the observed. Either way, quantum mechanics represents an intimately relational cosmos in which every phenomenon impacts other phenomena. Quantum non-locality likewise suggests that the elements of the cosmos are, at a fundamental level, intricately interconnected, even if the question remains open as to whether or not this relationality is ontologically superluminal and non-local.

Conclusion, by way of possible implications for meaning and ethics

Where am I left, then, once I have concluded that I can indeed view the development of the cosmos—including the Earth, which includes me—as *the process that gives rise to all that exists*? I am left within the process as I began, but with the difference that, having specified at least some of the character of the process via the natural sciences, I can formulate some possible implications for human meaning and ethical systems. In this section, I will begin this formulation in a preliminary and general way, in what I hope will provide the outlines of a project for further development. First of all, I address the question of meaning, specifically, Why meaning? Next, I address the question of ethics, specifically, What ethics?

Why meaning?

One might rightly ask why human beings have such a need to make meaning in the first place. Why does the question of the meaning of existence follow most assuredly on the heels of the admission of existence? Sociologist Peter Berger sees these questions as arising fundamentally out of the fear of chaos and, ultimately, of death.[27] Through meaning systems, human beings seek to avoid the reality of both by imposing a vision of order on the world, where order may otherwise not exist. While it is certainly the case that the fact of death imposes, at least on me, an urgency that life be lived in a worthwhile manner, I do not think, by accepting a naturalist, scientific account of the world, that I am necessarily imposing order where it might not exist. Still, I recognize that I am engaging in the age-old process of considering the world beyond human beings to be of ultimate significant to them. As Berger writes,

> Every society is engaged in the never completed enterprise of building a humanly meaningful world. Cosmization implies the identification of this humanly meaningful world with the world as such, the former now being grounded in the latter, reflecting it or being derived from it in its fundamental structures.[28]

In fully admitting that I am creating meaning, in a sense I believe that there is no other way to function. For even if one says that there is no meaning to human life in the cosmos, one is still making a judgment about what is and is not humanly meaningful, by constructing meaning precisely out of meaninglessness.

I would argue, however, that if one is bound to create meaning, then one might as well do it against the backdrop of the best possible information about the cosmos. This is why it has been so important to me to specify the "frame of ultimate significance" to be *that process that gives rise to all that exists*. In this way, I have been able to provide a potential basis upon which one could give a naturalist and scientifically informed account of human existence. From and to this account, then, I can be answerable with regard to a critical reception and interpretation of new scientific understanding of the process. This accountability should keep my meaning constructions from becoming obviously inappropriate projections of human desires and wishes onto nature, and from becoming obviously inappropriate projections of human grandeur within the process.

This accountability is efficacious on several levels. At one level, meaning systems must remain open and flexible, given that the natural sciences are constantly changing and refining their approximations of nature. At another level, meaning systems must be evocative enough to allow for continuity in the formulation of meaningful relationships between

human beings and with the rest of the natural world. These evocative constructions (even my own, *that process that gives rise to all that exists*) must be constantly scrutinized so that they do not become reified or isolated from their status as constructions always accountable to expanding scientific approximations. Finally, we are always already within the cosmos, within the process. At the same time that we create meaning by orienting ourselves to the process, that process gives rise to us (and perhaps other intelligent entities) as meaning-creating beings. Somehow our meaning systems must acknowledge this fact, along with the concomitant fact that we do not stand outside the process.

So why meaning? In the negative, because it is unavoidable. And in the positive sense, consonant with the natural sciences, because it is—at least in principle and potentially—better informed and more accountable.

What ethics?

If it is accepted that meaning-making is a practically unavoidable human endeavor, and, moreover, if it is desirable to keep meaning systems accountable by making them consonant with the natural sciences, then what are some of the concrete values that might be formulated? What implications does it have for action in the world if people orient themselves to *that process that gives rise to all that exists*? I have three preliminary suggestions of stances that seem consonant with the processes that I have detailed above. I put them forward in this conclusion, knowing that there are other interpretations of both the process and its implications, but also seeking finally to begin the process of constructing a personally meaningful framework for action.

I would argue, however, that if one is bound to create meaning, then one might as well do it against the backdrop of the best possible information about the cosmos.

Humility is the first stance I would suggest. Human beings are within a process some 13 to 20 billion years old, as far as we can tell (at least within the current expansion-and-contraction cycle of the cosmos). Meanwhile, our species has been on the cosmic scene for only a tiny fraction of this time. Temporally, humility seems appropriate. Additionally, and consequent to the nature of spacetime, humility seems appropriate given our minute scale in comparison with the universe. Spatiotemporally, we are blinks in the process of cosmic arising. Likewise, evolutionarily speaking, we are blinks in the arising of life on planet Earth. Billions of years and many epochs of geological formation separate us from the arising of the first life on Earth. Thus, closer to home, humility also seems requisite. Who are we, after all, to claim to understand the cosmos or to take responsibility for the Earth? We are doing pretty well, but we have a long way to go; and no matter how far we go toward these goals, the Earth and the process in which it arises as a part will continue long after all humankind has passed away. I start with humility because it chastens me to take account of my real situation and thrusts me once again into accountability to the natural sciences.

Secondly, as humans are conscious agential beings, a stance of responsibility seems appropriate. With proper humility about our status in the immense spatiotemporal span of both the cosmos and the earth, we can more fully see the aspects of our lives in which we can really take responsibility. Moreover, taking into account quantum mechanics, we can more fully comprehend the deeply relational nature of reality and, from that, see that it is crucial to act as

responsibly as we can, even if we can never know with full certainty that our actions will achieve their intended results. We are alive within an amazing, intricately relational process; and just this fact alone, I would argue, ought make us feel the responsibility to do what we can to formulate appropriate actions within the context of the natural world. As conscious beings, we can at least take responsibility for our own actions and, in this light, begin from a naturalist perspective to address the complexly interrelated issues of ecological destruction, human overpopulation, and human poverty.

Thirdly, I would argue that humble and responsible cognizance of *the process that gives rise to all that exists* should also include a stance of celebration. Our life is short. We have arisen on a small planet in a peripheral section of an unexceptional galaxy. We arose recently in the evolution of life on Earth—and we are still arising. We arise, moreover, as conscious and intelligent. As such, we are able to contemplate the process of our arising in the first place. To be properly oriented to all of these facts, I would argue, we must celebrate the first fact, that *that process that gives rise to all that exists* exists at all, and that we arise as existing within it. As Brian Greene writes,

> It is truly inspiring that beings confined to one planet orbiting a run-of-the-mill star in the far edges of a fairly ordinary galaxy have been able, through thought and experiment, to ascertain and comprehend some of the most mysterious characteristics of the physical universe.[29]

We must celebrate both our existence and its intelligibility. This celebration should then push us back into a greater understanding of exactly what the nature of the process is, and to humility and responsibility all over again.

Celebration returns us to humility and responsibility, since it forces us to see that not everyone can celebrate. Some have humility imposed on them through poverty, disease, and lack. They can neither define their humility nor take responsibility with reference to the process; rather, they have incommensurate humility and an inability, due to unjust circumstances, to take responsibility. Full celebration in this sense is contingent on working in humility and responsibility for the alleviation of conditions that cause poverty, disease and lack—both in the human realm and in the rest of the natural world. In this sense, celebration is always provisional and anticipatory. It is a call to more adequate understanding and enactment of human relationships to other humans and to the rest of the natural world. It is a call to an understanding of the process that has given rise to us and the rest of the cosmos, and that allows oppression and destruction, freedom and flourishing, both in the human realm and in the rest of nature.

The process that gives rise to all that exists, to which we are oriented, gives rise to a new day in which we may be appropriately humble, responsible, and joyous. We are alive. Many questions remain unanswered, but the day arises to allow for continued investigation. Ignorance must not be an excuse for inaction, for fear of unintended consequences. If life is to have meaning, we must make it, in as full a consciousness and understanding of the process as possible, so that at the end of our lives we may say with Maria Eugenia Baz Ferreira:

> To all that is brief and fragile
> superficial, unstable,
> To all that lacks foundation
> argument or principles;
> To all that is light,
> fleeting, changing, finite
>
> To all that is light in weight
> for itinerants
> on this transient earth
> Somber, raving,
> with transitory words
> and vaporous bubbly wines
> I toast
> in breakable glasses....[30]

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Endnotes:

1. The definition of existence will find its proper place and fuller expression below . For now, let me signal that I will treat the question of what it means to exist with reference to the spatiotemporal frame in which existing means being related to other existent entities; and I will treat the question of the existence of an entity with reference to its endurance with an internal, relational, organizational structure. Both of these formulations will then, in due course, find problematization in the context of quantum uncertainty and non-locality.

2. Naturalist orientational cosmology: each of these terms demands some explanation. By naturalist, I mean that the ultimate context of human life is the world specified in the natural sciences and that this world operates in the regular and intelligible ways discerned by the natural sciences. This meaning is in contrast to those who argue that the ultimate context of human life is supernatural, and that the world's regularity and intelligibility is violated by a supernatural being or force. My naturalist account is fully integrated with scientific ways of knowing and also acknowledges the necessity of philosophical ways of knowing concerning questions of epistemology and ontology in the natural sciences. I also see the importance of metaphorical ways of expressing the knowledge both of these provisionally produce. Finally, I recognize that scientific, philosophical, and metaphorical proposals are always provisional approximations of our best knowledge, rather than timeless propositional truths; but I seek to construct a system that can remain always open and critically receptive to new approximations. By orientational, I mean that my proposal seeks to address human questions of meaning and ethics and to provide open and provisional systems in

which individuals can address these questions. By calling my proposal a cosmology and in keeping with my naturalist orientational perspective, I mean to say that one studies the cosmos for naturalist orientation. It is in relation to the cosmos as a whole and in relation to all that exists therein (including human societies) that one seeks to orient one's life. In this, I am making a distinction between myself and not only those theologians who would see the supernatural as the ultimate frame of reference, but also those humanists who would see human society by itself as the ultimate frame of reference. At the same time, neither do I want my proposal to be seen as a-theist nor as anti-humanist. Regarding a deity, the proposal is neutral toward this hypothesis, which for this proposal is unfalsifiable and unnecessary. Regarding humanism, the proposal is supportive, but with the aspiration of expanding the frame of reference in which those concerned with human meaning and ethics construct their systems.

3. At one stage in its development, I assigned the word "God" to this process; but I now believe that the "baggage" of this term is too great for such an assignation to prove heuristically valuable. While I would not mean a supernatural or independently existing entity by the expression, *that process that gives rise to all that exists*, were I to denote it by the word "God," many people would interpret it as just such a supernatural and hypostatized proposal. At the same time, since I hope to construct a proposal that has the potential to provide, at once, both a system of meaning and of ethics, it will be necessary at some junctures to make my argument with reference to previous explicitly theological proposals—as theology is traditionally the realm within which such arguments are made and such orienting systems sought. However, I seek to develop a naturalist orientational cosmology, and not a theology.

4. Considerable rebate remains about whether the Big Bang can really be said to be a singularity, and ideologies cloud the conclusion from many sides. However, almost no one doubts in general outline that the Big Bang is the ultimate source of all of the phenomena that currently exist and that humans perceive. Whether the Big Bang we know is the first or one among many in an infinite series of bangs and crunches does not fundamentally change the human orientational need for a heuristic term that encompasses unity and plurality. My understanding of Big Bang cosmology comes primarily from *The Elegant Universe* by Brian Greene, and *Foundations of Modern Cosmology*, by Hawley and Holcolb.

5. See Margulis.

6. This process, as it took place in evolutionary biology, is well illustrated by Ruse, who explores how evolutionary biology became more and more precise in its understanding of the natural world as its scientific proponents gathered, and emphasized the gathering of, more evidence through the years.

7. The contention that an ethical system can be developed from a consonance with the natural sciences might cause considerable unease for some people. Earlier in the development of the natural sciences, perhaps one could not have proposed the type of orientational cosmology that I am proposing. Indeed, those who did are now seen to have been mistaken—for example, those who saw the regularities of nature to indicate that the different species and phyla were each the result of a static creation and individual design. Currently, however, at least the general trends of the natural world towards expansion of the cosmos and biological development of planet Earth are well enough established that one is likely to be correct in working from them. At the same time, the naturalist orientational cosmologist, no less than the scientist, should always be ready to

amend her proposed cosmology in light of new data, metaphors, or interpretations. The burden of making a proposal is always that one may be wrong; yet the possibility of error cannot prohibit the beginning of an endeavor, or no progress whatsoever can be hoped for.

8. See Greene.

9. An interesting question, and one that I leave unanswered for the moment, is how to account for the intelligibility of the process. Why is it that the cosmos is open to human understanding? One possible answer arises from the fact that the human brain is among those entities to which the process gives rise. The brain is—by its nature as a part of the process—fit to understand the process. It would take a stronger argument than that, though, to convince me, at least. Many creatures, for example, the non-humanoid higher primates, have large brains that, according to our best knowledge, are not capable or intrinsically employed in seeking out understandings of the process. Another related question is how to account for the status of mathematics. Why is it that math is so well suited to use in understanding the natural world? Is there some intrinsic relationship between math and reality? Many mathematicians themselves refuse to answer this question. Much in mathematics seems to have no direct bearing on the natural world. However, could it not be the case (as it was with Einstein's use of Riemannian geometry) that mathematics proceeds ahead of the sciences and that eventually, perhaps many centuries from now, the sciences may discover exactly how the math actually relates to the natural world? I do not have an answer to any of these questions, but it seems that a fully adequate orientational cosmology that is also philosophically rigorous would want eventually to account for the fact that the universe is intelligiblevia mathematics and other human forms of cognition.

10. One answer to this question is that, while science can explain all that arises, it cannot account for the "beginning" of this arising. This answer is a serious one and is deserving of some reflection. One should realize, however, that in giving the answer one assumes a beginning, a matter that the sciences are by no means decided on in the sense of $t = 0$. String Theory suggests that the cosmos does not reach $t = 0$, but rather that the cosmos finds its smallest unit at Planck length (10^{-33} cm). At the same time, different scientists have different motivations for concluding either for a beginning at $t = 0$, or for an infinite process of crunches and bangs that always exists, never beginning or ending. At first glance, those that conclude on the side of the $t = 0$ position seem more reasonable; yet as I have studied the world religions, I have come to believe that neither position is essentially more reasonable; for example, one could look to the vision of an eternal, cyclical cosmos in some schools of Hinduism. Rather, the ideological and metaphysical frameworks that one brings to the question can have both conscious and subconscious influences on what one decides. Whatever the case may be, the hypothesis of $t = 0$ is both an empirical question remaining to be solved and, as the Buddha said, "a question that tends not to edification" (at least at the present time).

11. In its vagueness, a supernatural element cannot be excluded by saying that the ultimate frame of reference for human meaning and ethics is the process that gives rise to all that exists. It can be said that this supernatural element appears unnecessary within a naturalist perspective. At the same time, the process as *giving rise to* also leaves open the question of the beginning of the process—or lack thereof. I am comfortable with this ambiguity; and, with the Buddha, I am not sure that questions of an absolute beginning or of the eternality of the cosmic process are ultimately of edifying value.

For the type of orientation that I suggest in the concluding section, what is most important is an understanding of the human location within a thoroughly relational process, and not whether this process has an ultimate beginning or continues everlastingly.

12. My understanding of chaos theory comes primarily from Hayles.

13. My understanding of the consequences of Bell's theorem comes primarily from Herbert's explanation.

14. I can provide only the briefest sketch of such fragmenting or dichotomous views. This sketch is bound to be a generalization; yet because the formulation of the *all* can only be understood in relation to such fragmenting proposals, for heuristic purposes, I risk over-generalizing them.

15. Dichotomies and even greater fragmentation also arise in many religions and traditions. I simply use the Western tradition, because it is the one most familiar to me, the one in which I was raised. More work could certainly be done, however, regarding the dichotomization and fragmentation of the cosmos in the various meaning and ethical systems of human history. From a naturalist perspective, as odd as it is not to think of the world as a whole or at least as constituting a unified process, I would hypothesize that the position of fragmentation certainly finds expression in at least as many traditions as the unified position.

16. Mayr, p. 241.

17. Wilson's *Consilience* may at least provide suggestive avenues for further understanding of their relation.

18. The concept of negative impact is a human one and reflects human valuations of our own existence and the rest of the natural world. Sorting out negative impact is very complicated and requires a case by case analysis of costs and benefits of particular actions and events. While I mention "inhibiting flourishing" here as one standard for measuring negative impacts, there are certainly others, including "doing harming," "interfering with the natural course of things," and "abuse." Each of these standards of negative impact carries pluses and minuses, and none is clear-cut as an unequivocal standard. Were a naturalist orientational cosmology to be truly adequate, it would have to develop sophisticated ways of adjudicating competing claims, as well as of evaluating different standards of what constitutes both negative and positive impacts. By my brief comments in the body of the paper, I simply mean to indicate that it is possible to make such judgment within a naturalist framework and remain consistent within the rest of the system.

19. Mayr, p. 241.

20. Again, as is the case with human valuation of evil or deleterious effects, the natural sciences' understanding of consciousness and the human mind is very complicated. Moreover, much remains to be understood about the exact relationship of human beings to their primate ancestors. What can be said, as Lynn Margulis has (in a lecture at Boston University, 19 November 1999), is that humankind undoubtedly shares better than 98% of their DNA in common with the higher primates.

21. Delaney, p. 169.

22. The success of an experiment is by no means unequivocal. What I mean here is that the experiment produces results that allow for further understanding and further theory formation. Moreover, not all of the sciences undertake experiments in the same way as they are in chemistry, genetics, or physics; but, as is the case in evolutionary biology, some have to collect and compare historical data, using the process of the cosmos as the experiment and, thus, having to deal with many more variables than laboratory scientists have to.

Construal of what it means to have a successful experiment or successful theory must, thus, be appropriate to the particular scientific discipline in question. With my discussion of experiments in the body of the paper, I simply mean to give an example of one possible way that a critical realist comes to an approximate understanding of the cosmos that exists external to him- or herself.

23. Herbert, pp. 68-69.

24. Ibid., p. 69.

25. Ibid., p. 245.

26. Ibid., p. 242.

27. Berger, p. 26.

28. Ibid., p. 27.

29. Greene, 117.

30. "To all that is brief and fragile," by Maria Eugenia Baz Ferreira. In *Earth Prayers from Around the World: 365 Prayers, Poems and Invocations for Honoring the Earth.* Ed. Elizabeth Roberts and Elias Amidon, 187. San Francisco: Harper Collins, 1991.

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Language and Ideology: A role for scientific metaphor

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A number of prominent popular science writers have recently argued for the active appropriation of scientific language in the formulation of modern ideologies and ethical systems. A critical examination of scientific narratives in light of contemporary theories of metaphor and relevance suggests that scientific language indeed harbors the same emotive potential that is traditionally ascribed to religious language, and can exhibit potent transformative effects in shaping human thought. Also highlighted through this approach are the challenges of constructing scientific metaphors that are generally meaningful, accurate, and ethically responsible.

> The true evolutionary epic, retold as poetry, is as intrinsically ennobling as any religious epic. Material reality discovered by science already possesses more content and grandeur than all religious cosmologies combined.... *Homo sapiens* is far more than a congeries of tribes and races. We are a single gene pool from which individuals are drawn in each generation and into which they are dissolved the next generation, forever united as a species by heritage and a common future. Such are the conceptions, based on fact, from which new intimations of immortality can be drawn and a new mythos evolved.[1]
>
> –Edward O. Wilson, *Consilience* [1998]

Personal reverie and "grandeur" aside, E. O. Wilson has proposed here a rather striking program for the intimate association of scientific "fact" and human ideology. And although he may be one of the most influential and visible proponents of such a program, he is certainly not alone. A number of prominent science writers have recently added their voices to the argument for the value of scientific understanding in the formulation of worldviews and ethical systems.[2] Their position suggests a growing conviction within the scientific community that scientific language might reasonably vie for a position alongside religious language (if not, as Wilson explicitly indicates, wholly replacing it) in the role of informing modern ideologies. Clearly such claims hold important implications for the dialogue between science and religion and for the popular conception of the roles these two disciplines assume in the shaping of human thought.

The role that religion plays in shaping ideologies and ethical systems has been widely explored and has been portrayed by some scholars as its primary function. In *The Interpretation of Cultures*, Clifford Geertz talks of religions as symbol systems that provide models *of* reality, as well as models *for* reality, by establishing "powerful, pervasive, and long-lasting moods and motivations."[3] Religious symbol systems not only tell adherents what reality is like, but also provide the structure by which they inform their activity within that reality. A number of detractors have claimed that Geertz' characterization of religion as a whole is insufficient; for the present purposes, however, it seems that Geertz offers, at the very least, a great deal of insight into the function of religious language in shaping human thought. The comparisons that

Wilson invites between scientific and religious *language* suggest that scientific language, too, might be profitably thought of in this light. Indeed, Wilson's arguments seem to imply that scientific language might serve the very function that Geertz outlines for religion. Certainly in the passage cited above Wilson appears to be suggesting that the facts of the evolutionary narrative might not only provide a framework for the understanding of "material reality," but might also serve to establish such "moods and motivations" that inform human activity in the world. Wilson ultimately applies this formulation to suggest explicitly that scientific fact can inform ethical systems—in other words, that scientific language not only serves the straightforward function of providing a model *of* the world, it also provides a model *for* the world.

The complex interaction between religious language and personal ideologies has, in more recent years, been the subject of a great deal of study, not least in theologian Sally McFague's seminal examinations of the role of religious metaphor.[4] Similarly, a number of texts have considered the role that scientific language plays in the development of scientific theories.[5] Although these latter works have reflected on the role of models and metaphors *within* science, the implications of such language for popular ideology outside of science are largely not addressed. What is required is a critical assessment of such arguments as Wilson's. Can scientific language really hope to provide the kind of meaningful models for human attitudes toward the world (assuming that one of science's most widely accepted functions is to provide models of the world) that are traditionally ascribed to religious language? If so, what responsibilities does science have in forwarding particular narratives as aspects of a "new mythos"? In particular, how can scientific "facts" be translated into language with positive transformative power?

It is the aim my aim here to attempt to address such questions. The first section examines both the extent to which scientific language is capable of informing ideology, and the active role that science must play in proffering scientifically informed worldviews. Contemporary theories of metaphor and relevance will be employed in an attempt to evaluate accurately the potential efficacy of scientific metaphor in shaping popular thought. The second section explores these findings in the context of a case study, by considering the scientific theory of geophysiology (more popularly known as Gaia theory) and its ramifications for understanding metaphor as a link between science and popular thought. By exploring these topics it may be possible to move the discussion of scientifically informed ideologies toward a more thorough understanding of how science can positively play a role in the influence of contemporary worldviews.

Can scientific language really hope to provide the kind of meaningful models for human attitudes toward the world that are traditionally ascribed to religious language? How can scientific "facts" be translated into language with positive transformative power?

Scientific language in light of theories of metaphor and relevance.

The importance of metaphor in the communication of theory within the scientific community is frequently noted, and many scholars have pointed to the futility of insisting that science make greater attempts to eschew figurative language. This futility is perhaps not surprising, given the ubiquity

of metaphor; as linguistic theorist Andrew Goatly writes, "metaphor is not something that can be easily confined, but is an indispensable basis of language and thought."[6] More importantly, however, philosophers of science and linguists alike have also emphasized that metaphor provides an essential function in scientific inquiry, contributing most obviously to the fertility of scientific theories.[7] Thus, it is to some extent the ambiguity and vagueness of scientific language that provides what Ian Barbour calls "a continuing source of possible applications, extensions, and modifications of theories."[8]

Similarly, metaphor must play a vital role in the communication of scientific understanding beyond the boundaries of academic science. Here also the necessity of metaphor is apparent. A recent survey of metaphor content in a variety of written and spoken language genres shows that in popular science writing 18% of the total language can be characterized as active metaphor.[9] (Compare this figure to values such as 28% for modern novels, 10% for conversation, and 4% for national news reports.) But what is the function of such metaphors? Do they simply provide the best approximation of scientific theory that is accessible to a popular audience? Or can they, as Wilson suggests, actively inform popular attitudes toward the world?

On one level, metaphor can simply be understood as "an invitation to make comparisons."[10] The propositional form that the metaphor takes differs in some way from the referent of the metaphor, forcing an assumption on the part of the listener that these two things have some identifiable commonality.[11] Thus, the proposition, "he flew from the room," invites an assumption that something about this individual leaving the room is similar to the act of (say, a bird) flying. The interpreted thought (the individual leaving the room) differs in a concrete way from what is proposed in the structure of the metaphor (the individual "flew"), but stimulates a comparison between the two forms. Specifically, "the metaphorical meaning ['he flew'] does not belong to the target item's [the individual leaving the room] field of experience, or domain."[12]

In light of this characterization of metaphor, Wilson's statement that "we are a single gene pool" is seen not to be a literal observation, but a metaphorical one. Clearly there are concrete differences (embodiment, culture, society, to name a few) that exist between the human species as a whole and the set of alleles that constitute its "gene pool." But Wilson's metaphor constructs a situation in which the reader is forced to recognize that there are similarities between these two entities. (It is interesting to note that "gene pool" itself is a metaphorical construction, one which Wilson plays off of eloquently in his language of "drawing from" and "dissolving into.") The experience or domain of humanity does not include the experience of being a "gene pool" (whatever that experience might be), any more than the experience of any single individual includes the experience of "flying" from a room.

How is it, then, that metaphorical construction alters the meaning of the literal proposition? In one sense, the meaning of the metaphorical statement is increased by its intended implicit information content.[13] In the previous example, the verb "flew" implicitly informs the listener's conception of how this individual left the room; thus "he flew from the room" might change the interpretation of the proposition from "he left the room" to "he left (swiftly) from the room." The most important aspect of this implicit information content, however, is that it produces an emotional effect in the listener that alters the meaning of the proposition.[14] The proposition "he flew from the room" conveys emotional content that is lacking in the literal and emotionally neutral proposition "he left the room." Such emotional content may be ambiguous; in this particular context, it depends most obviously on whether the individual is flying from something or flying to it. Nevertheless, the meta-

phor possesses emotional information that is absent from the literal proposition.

This discussion may provide some insight into what exactly is intended in Wilson's description of humanity as "a single gene pool." The metaphorical construction is calculated to provide implicit information with emotional content. Specifically, the language of the gene pool is meant to introduce content of inclusiveness and unity that Wilson apparently sees lacking in other propositional constructions of the form "humanity is...." Individuality is lost in the "gene pool"; the comparisons are implicitly drawn between the human species and an entity in which the "individual" (the set of genes possessed by a single human organism) is reduced to a transient subset of the whole. The emotional content of the concept of such intimate unity (so intimate that the individual, in our common-sense definition, no longer exists) is central to Wilson's use of the metaphor.

One further aspect of metaphor deserves consideration in the context of this discussion. Linguists have devoted a great deal of study to the pervasiveness of ideological metaphor in human communication. The emotive content of metaphor suggests that metaphorical constructions (and arguments from analogy in general) possess the capability of influencing attitudes and informing human activity. They "seem to be embedded in the sphere of human activity in the world. They argue for doing something."[15] This persuasive aspect of metaphorical language has been recognized not only in terms of literary metaphor,[16] but also in terms of common language and the emotive and constructive (or destructive) power of "root analogies."[17] Such analogies are deeply embedded in human linguistic constructions, and powerfully inform human attitudes and activity. One striking example, cited by Goatly,[18] is that of the analogical equivalence of "first" and "important" (as evidenced in the common saying, "First things first") and the influence that such a root analogy has had on global politics in reference to the metaphor of "Third World countries."

This emotive power of metaphor to shape attitudes and induce activity is at the root of Wilson's use of the "We are a single gene pool" metaphor. The implicit and emotive information content of the metaphor is not simply intended to convey the equivalence of humanity with Wilson's view of a unified, non-individualistic entity. It is, by extension, meant to induce people to act in response to this implicit information in a manner that reflects that unity. This is ultimately the intention of Wilson's adoption of such evolutionary metaphors; the "facts" of evolution, imparted with emotive power through metaphorical construction, are intended to inform an ethical system in which humans act in a manner consistent with their common genetic heritage and future.

By now, however, it may appear obvious that some other considerations must be made in evaluating scientific metaphor. Specifically, although for Wilson the concept of the "gene pool" is connected emotionally with concepts of unity, heritage, and even "immortality," one might wonder just how much of this intended implicit information content is transferable to the reader of the text. Clearly, this all depends very much upon who that reader is. Relevance theory is an area of research designed to assess the theoretical interaction between information and its interpreters, and has been applied to the investigation of metaphor in the context of its ability to inform the reader or listener. At the most basic level, relevance theory states that information gains relevance for an individual through interaction with that individual's personal thoughts and beliefs.[19] However, a good deal more sophistication enters into the calculus of just how such interaction occurs. Sperber and Wilson provide one of the most straightforward methods of assessing relevance in terms of two separable means in which information interacts with the specific individual's thoughts and be-

liefs.[20] The first of these is described by the "contextual effect" of information. The greater the contextual effect, the greater the relevance. To provide a simplistic illustration, the statement, "The orchestra built a cathedral of sound," might provide a great deal of meaning to someone intimately familiar with religious architecture; somewhat less to an individual who has seen photographs of cathedrals but never been inside one; and virtually nothing to someone who replies, "What's a cathedral?" In order to be relevant, the domain of the proposition must have some referent within the domain of the interpreter of the proposition.

The second influence on relevance is the "processing effort" required actually to understand the proposition, which relates to the complexity of the proposition and that of the concepts embedded within it. The metaphor above ("cathedral of sound") requires relatively little processing effort, although it might be considered more difficult to process than the previous example ("He flew from the room"), if only for the potential difficulty in digesting the concept of a "structure of sound." This processing effort relates in an inverse manner to the relevance of information: the greater the processing effort, the lower the relevance. Thus, relevance can be represented in total as proportional to the contextual effect divided by the processing effort.

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What becomes immediately obvious is that scientific metaphor (at least in the context of extradisciplinary communication of information) most often concerns itself with inherently high processing effort. The language of much contemporary science is highly technical and highly specialized; for individuals unfamiliar with a particular scientific discipline, the effort required to process information from within that discipline is potentially enormous. Thus, it has been observed that the language of popular science (which is, by definition, communicating outside the discipline) requires a concerted effort on the part of the scientist ("addresser time"), in order to provide metaphorical constructions that require relatively little processing effort ("addressee time").[21] Considering the language of academic scientific journals, one would expect this imbalance to shift markedly to the other side, with a great deal more addressee time required and a great deal less expenditure of addresser time to simplify the language in which the information is conveyed.[22]

This requirement for active reduction of processing time in popular scientific literature has led to an unusually high utilization of the particular form of metaphorical construction known as the transfer metaphor.[23] Transfer metaphor represents the greatest degree of dissimilarity between the metaphoric proposition and its specific referent; it is a heuristic tool for transferring difficult-to-process information into an easily processed form. A typical scientific transfer metaphor (familiar to anyone who has gone through a basic cell biology course) is the statement that "the mitochondrion is the power plant of the cell." There is virtually nothing at all that is similar between a mitochondrion and a power plant, with the exception that, in both, raw

materials are converted into usable energy forms. But this one similarity is the very point that the metaphor wishes to stress; and by executing the transfer, the complicated biochemical and cell biological entity, "mitochondrion," is made available in a form that is more accessible to the non-biochemist. Transfer metaphor, in general, is a highly utilized form of metaphor; in the survey of genres mentioned above, transfer metaphors represent on average 70% of all metaphorical language. In the case of popular scientific writing, however, this number skyrockets to 97%; virtually all metaphorical language in this genre requires such radical reconceptualization.

From its inception, Gaia theory has not only played an important role in informing scientific research on planetary ecosystems and global homeostasis, but has also served as an unusually complex model for the role of metaphor in scientific discourse.

All of these forces are at work in Wilson's constructive use of the "gene pool" metaphor. "Gene pool," as a scientific concept, represents a description of the set of alleles among the reproductive members of a given population (in the case of "humanity," that population being the species, *Homo sapiens*). It is also intimately linked with an understanding of how allelic frequencies contribute to the genetic composition of that population. The introduction of the concepts of alleles assumes some sophistication in processing, requiring some understanding of how individuals contribute statistically to the overall allelic population. The metaphor of the "gene pool" does more than just simplify the language. The set of alleles concerned is not literally a "pool" any more than the money collected for a little intra-office gambling on the NCAA championships is literally a "pool." But in both cases, the metaphor encourages the recognition of conceptual similarities that provide implicit meaning to the proposition. The "pool" is something into and out of which something flows, whether it is money or the particular set of alleles that can be ascribed to one reproductive individual. It is this conceptual bridge that Wilson seeks to build in utilizing the metaphor; and, thus, by transferring a relatively complex scientific concept into a relatively simple and easily processed metaphor ("pool"), he is able to increase greatly the relevance of his statement to the general reader. The implicit depiction of individuals flowing into and out of a more or less constant "pool" that is humanity is powerfully emotive, and designed to induce moods and attitudes appropriate to the feeling of unity and flow implied in the metaphor.

The question of contextual effect, I think, remains more elusive. How does the metaphor of the "gene pool" interact contextually with the thoughts and beliefs of the reader? The "pool" metaphor generally possesses high contextual effect, even for a general audience. Nevertheless, for some individuals (e.g., those with relatively little familiarity with the concepts of evolutionary biology and unsure as to how humanity might relate to its gene pool), the metaphor may be less contextual, and may lack relevance, despite the efforts of Wilson to reduce the processing effort. For others (e.g., individuals like Wilson himself, fluent in the language of evolution and possessing an intuitive understanding of these concepts), the contextual effect may be great. There may also be other factors, beside familiarity with scientific concepts, that determine the contextual effect of the metaphor. It is interesting to note here that, even within the academic study of science, a variety of differ-

ent metaphors have been adopted to explain the same observations. The cultural influences on the development of such metaphors in evolutionary biology have been noted,[24] and it is not difficult to see that contextual effect has played the major role in determining which metaphors have been adopted by which individuals (or groups of individuals), despite the arguable equivalence in the effort required to process these metaphors. In any case, a great number of factors may contribute to the contextual effect of a given scientific metaphor, and the overall effect may, therefore, be difficult to predetermine.

It appears that theory of metaphor and relevance can, initially at least, support Wilson's assertions regarding the possibility of scientific language serving transformative functions, providing that the language is actively metaphorical. This support stems from the very nature of metaphor, which serves to provide emotionally laden, implicit information that is capable of generating attitudes toward reality and, ultimately, of informing human activity. It is interesting that Wilson explicitly acknowledges the importance of metaphor in this respect, appealing to scientific concepts "retold as poetry." This point must be stressed. It is not enough to say that scientific "fact" alone can serve the function that Wilson advocates. Literal scientific language (or literal language of any sort) does not necessarily possess the emotive (and, thus, ultimately transformative) power inherent in metaphor.

Assuming, then, that scientific metaphor, just as religious metaphor, has the potential to inform ideology and ethics, the caveat that must be addressed is the relevance of scientific metaphor. How can science provide narratives that are relevant to a popular audience, relevant enough to effect changes in attitudes and activity? A good deal of work has been done on maximizing relevance of religious language. Feminist theologies, for instance, often ground themselves on the assertion that many traditional religious metaphors are rooted in a male-centered contextual framework and lack, therefore, the contextual effect needed to make them maximally relevant to female believers. Discussions in religious circles concerning increasingly "inclusive language," thus, refers directly to attempts to increase the relevance of religious metaphor through increasing contextual effects. Similar questions must be posed in the scientific context. The difficulty of processing effort is intuitively noted among science writers, as evidenced in the extraordinarily high frequency of transfer metaphors. The issue of how scientific metaphor can maximize its relevance by actively addressing contextual effects must also be taken into consideration, and it is here that the ultimate efficiency of scientific language in shaping ideologies may be determined.

How do scientists engage in this maximization of relevance? I now present a case study of a particular scientific metaphor, to examine the different ways in which scientists have constructed language to inform a general audience, and the issues that these differences raise for the possibility of truly transformative scientific narratives and the responsibility of scientists in actively formulating such narratives.

A case study: Gaia theory

Gaia theory is the brainchild of James E. Lovelock, stemming initially from his work in the 1960s for NASA on the examination of possibilities of life on other planets in the solar system, particularly Mars.[25] Through observations of atmospheric conditions on Earth and other planets, as well as through modeling of atmospheric conditions on a hypothetical Earth devoid of life, Lovelock came to the conclusion that the radically non-equilibrium composition of Earth's atmosphere could result only from active maintenance by living systems. By the late '60s, Lovelock had formulated the following hypothesis:

> The chemical composition of the atmosphere [of Earth] bears no relation to the expectations of steady-state chemical equilibrium. The presence of methane, nitrous oxide, and even nitrogen in our present oxidizing atmosphere represents violation of the rules of chemistry to be measured in tens of orders of magnitude. Disequilibria on this scale suggest that the atmosphere is not merely a biological product, but more probably a biological construction.[26]

Lovelock's vision was of an entity of planetary scale, one actively participating in a homeostatic process that provides for the maintenance of atmospheric conditions optimal for living systems. The unusually evocative name for Lovelock's hypothetical supersystem was provided by novelist William Golding, who recognized the metaphorical link between a unified planetary-scale entity and the ancient Greek conception of the Earth goddess. From its inception, then, Gaia theory has not only played an important role in informing scientific research on planetary ecosystems and global homeostasis, but has also served as an unusually complex model for the role of metaphor in scientific discourse.

The utilization of Gaia is, perhaps, one of the most extraordinary examples of scientific transfer metaphor available. Lovelock originally defined Gaia as

> a complex entity involving the Earth's biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet.[27]

This proposition differs so radically from the metaphorical proposition "the planet Earth is like the ancient Greek Earth goddess," that it is hard to imagine Lovelock's justification in choosing the metaphor. It is clear from his own descriptions of the early phases of the theory that Gaia was chosen both for its ability to reduce the processing effort associated with the complex scientific concepts embedded within his hypothesis, and also for the explicit contextual relevance possessed by the concept of the Earth goddess.

Lovelock's discussions of Gaia theory are replete with depictions of the Earth as an "organism," as the "living planet", or as "a total planetary being."[28] His personal interpretations of his own scientific observations suggest that the resemblance between, on the one hand, the complex integration of nonliving and living systems on a global scale and, on the other hand, a single living organism were sufficient to warrant the use of such transfer metaphors. It is, in part, this organismic unity that is communicated in the utilization of the Gaia metaphor. In addition, the language of Gaia seems to argue not only for a planetary-scale *identity*, but also for a planetary-scale *agency*. The idea that the Earth participates actively and *intentionally* in the homeostatic regulation of its atmosphere in a way that is optimally conducive to the maintenance of life is another integral aspect of Lovelock's conception of Gaia. This idea of purposeful action is, in many ways, a teleological interpretation of the unlikelihood of attaining such optimal conditions without some sense of intentionality. The metaphor of Gaia thus implicitly conveys the aspect of agency inherent in Lovelock's personal rendering of the scientific evidence for his theory. What becomes clear, then, is that Lovelock's adoption of the Gaia metaphor is intended to convey implicit information that is not inherent to the data—in other words, information that does not belong to the domain of the referent.

In retrospect, Lovelock could not have chosen a more effective metaphor. Not only has Gaia stimulated a growing debate within the scientific community over the various aspects of homeostatic regulation on a planetary scale (including the organization of international conferences on the subject, the second of which was held in 1996 at Oxford), but it has also insinuated itself into the public consciousness to a degree that few other scientific metaphors have. Various groups dedicated to the kind of holistic ontology represented in the Gaia hypothesis have actively appropriated the metaphor.

Most particularly, social action groups have employed Gaia to further environmental and ecological consciousness and to stress the importance of acting toward the Earth in a manner that is commensurate with its newfound identity as organism or even goddess. The metaphor has further found itself adopted by a variety of "New Age" organizations, which see Gaia as scientific support for a spiritual and/or mystical association with the Earth; such personification has brought Gaia into intimate conversation with other aspects of New Age movements, specifically goddess worship. In short, the Gaia metaphor has stimulated emotional responses, attitude changes, and human activity in an almost runaway fashion.[29]

The response of scientists to this massive popular appropriation of Gaia has not been overwhelmingly positive. Lovelock himself has turned away from his original metaphor, now adopting the language of "geophysiology," a metaphor that maintains the association of the Earth with an organismic unity, but severs connections with the concepts of personality and spirituality that have become intimately tied to the popular conception of the Gaia metaphor. Lynn Margulis, one of the few early supporters of Lovelock's theory and an important contributor in her own right, vehemently opposes the popular distortions of the scientific basis of Gaia theory by "anti-science and anti-intellectual folks."[30] "Gaia is no vague, quaint notion of a mother Earth who nurtures us. The Gaia hypothesis is science."[31] Margulis sees it as important to stress the scientific basis of Gaia theory and the value of the theory in promoting a research program. She notes that the affinity of New Age groups for Gaia and the fact that the metaphor stimulates in the public consciousness direct associations with mythic beliefs subject the theory to the criticism of being "unscientific."

Her fears are likely not unfounded. Lovelock and Margulis belong to a relatively small group of scientists who support what is known as "strong" Gaia theory, only one of many theories that fall under the rubric of Gaia theory as a whole. In its strong form, the theory suggests an active role of the living planetary supersystem in maintaining conditions optimal for life. Other forms range from "influential" Gaia, which accepts that living systems influence such abiotic planetary-scale functions as atmospheric composition and temperature, a hypothesis that is widely accepted and described by Margulis as "old news"; to "teleological" and "optimizing" Gaia theories, which comprise the "strong" Gaia supported by Lovelock and Margulis.[32] It is perhaps not surprising that strong Gaia theory has encountered resistance from the scientific community, given that community's tendency to eschew language of teleology in explaining natural phenomena. The struggle for strong Gaia supporters within the scientific community appears to be difficult enough, without accusations that the theory lends itself to spiritual and mystical interpretations of planetary systems.[33]

Many within the scientific community argue that Gaia is metaphor gone bad. So radical a transfer metaphor has imparted information that was never intended, and the subsequent distortions of the message have been so great that the popular conception of Gaia theory no longer bears any relation to the science it was meant to communicate.

One thing that is clear is that scientific metaphor lies at the heart of this debate. How do the metaphors through which science is communicated to a general audience alter the science itself? When does the acceptable science of cybernetic homeostatic systems on a planetary scale cease to be science and start to become New Age spirituality or environmental rhetoric? On the one hand, it is possible to argue that the Gaia hypothesis represents scientific metaphor at its very best. Within the scientific community, the ambiguities implicit in the association of Lovelock's data with the Earth goddess have stimulated ferocious debate and encouraged a great deal of research designed to specify more convincingly the nature of the planetary homeostatic tendency. As far as a more general audience is concerned, Gaia demonstrates conclusively that Wilson is right—scientific language can (and *does*) possess the same kind of transformative power that religious narrative can provide. Gaia has altered human attitudes toward the planet at large and, in doing so, has stimulated human activity commensurate with those attitudes.

The ambiguity and imprecision of scientific metaphor is both the means to the construction of powerfully emotive scientific language and the means to the potential obfuscation of the concepts it is meant to convey.

On the other hand, however, many within the scientific community argue that Gaia is metaphor gone bad. So radical a transfer metaphor has imparted information that was, in fact, never intended; and the subsequent distortions of the message have been so great that the popular conception of Gaia theory no longer bears any relation to the science it was meant to communicate.

In this new light, how are Wilson's claims to be read, that science "retold as poetry" can provide the foundations for narratives with transformative power? Certainly Lovelock's Gaia represents science retold as poetry. Is it just *too* poetic? Metaphor, through its implicit and emotional information content, may be seen intentionally to invite interpretation. The danger of metaphor is that it also invites *mis*interpretation, or as one linguist puts it, "surplus interpretation."[34] Effective metaphor can convey in a relevant fashion the information present in the original, non-metaphoric proposition. But it also always conveys more. To say that the mitochondrion is the power plant of the cell conveys, in a processing-friendly and contextually effective way, information regarding the role of the mitochondrion in cell metabolism. But it also provides implicit information that potentially misinforms the interpreter regarding the nature of the mitochondrion. So with Gaia theory, and so also, potentially, with Wilson's metaphor of humanity as a gene pool. This ability to convey misinformation is an inescapable aspect of metaphorical language, and its consideration has important implications for the possibility of formulating transformative scientific narratives. The ambiguity and imprecision of scientific metaphor is both the means to the construction of powerfully emotive scientific language, and the means to the potential obfuscation of the concepts it is meant to convey.

The problem of constructing meaningful scientific narratives is, thus, a delicate balancing act, between providing contextually effective and understandable metaphors on the one hand, and maintaining precision and scientific rigor on the other. What the present understanding of meta-

phorical language suggests is that science cannot forego the former if it is to provide language that is meaningful and potent, in the sense of establishing effective models *for* reality. This function of scientific language relies heavily on metaphor to convey implicit and emotive information content to the interpreter.

Lynn Margulis and other scientists who oppose the distortions of Gaia theory that accompany its appropriation by various environmental and New Age groups present an important critique of scientific language, and in particular of Wilson's claims that it can stand beside religious language in molding human attitudes toward reality. Yes, it works; but what results can hardly be called science! If science wishes to play a role in shaping ideologies, however, its reaction must not be to insulate itself from a general audience or readership by limiting the accessibility of its language. Only by an active participation in the discussion and re-evaluation of scientific metaphor, can science play such a role. It is not enough to chastise the "environmentalists and religiously-inclined people...[for] giving Gaia a distinctly nonscientific connotation." [35] After all, if such people bring nonscientific, surplus meaning to scientific metaphor, they are doing only what the very nature of metaphor invites them to do. It is necessary, rather, to enter directly into discussion with such people and actively establish new metaphors that better reflect the scientific reality and yet retain the ability to motivate emotionally and to stimulate positive activity. If science is to enter into the game of contributing to the construction of human ideologies, then it must come ready to play. Metaphor is science's most powerful tool in its attempts to shape human thought and action, but it is one that must be handled with care.

Responsible scientific metaphor and contemporary ideologies

It seems, then, that scientific language is in no way inherently incapable of providing meaningful and transformative narratives. Despite the deeply technical and specialized nature of much of today's science, and despite accusations from its detractors of coldness, detachment, or even nihilism, science has the capacity to spin tales that possess real meaning and ideological value. Perhaps the reason behind such impassioned statements against science is the misconception that science deals exclusively in facts. And facts, as we all know, are cold and hard. Facts alone are inert and unreactive. They lack the capacity to draw out the emotions, to make action imperative. Science, however, does not trade in mere fact. Scientific facts are communicated in language, and (for the most part) the language of science is the same language used in any communication. It is part of the job of the scientist to effect such transformation of fact, to turn simple observations of the world into accounts of what our world is like. And in doing so, fact is potentially transformed, through language, into narrative that is moving, engaging, and even, as Wilson puts it, "sacred."

But this task of transformation is not one to be taken lightly. To suggest that scientific fact can form the basis of ideologies and ethical systems is not to say that it is a simple matter of observing the world and translating those observations into parables that help us lead our lives. The construction of scientific metaphor is an active pursuit, and when one combines the emotive power of such metaphor with the fact that intentional misinformation is inherent in any metaphoric construct, the danger becomes readily apparent. It is one thing for a first year biochemistry student to have over-anthropomorphized the mitochondrion, or even for a New Age mystic to claim 'scientific support overzealously for an Earth goddess. It seems quite another when one encounters such interpretations as the following:

> I wish very much that the wrong people could be prevented entirely from breeding; and when the evil nature of these people is sufficiently

> flagrant, this should be done. Criminals should be sterilized and feeble-minded persons forbidden to leave offspring behind. The emphasis should be on getting desirable people to breed.[36]

It is tempting to ascribe such words to the marginal eugenic fanatics of the world. These particular words happen to come from Theodore Roosevelt. And the President was not alone; many other prominent and well-respected individuals have provided the world with similarly spectacular statements. Linus Pauling, one of the greatest minds the field of biology has ever known, winner of not one, but two, Nobel Prizes (one for Peace), once remarked (apparently quite earnestly) that in the future all individuals should be branded with an encoded representation of their exact genotype, so that

> two young people carrying the same seriously defective gene in single dose would recognize the situation at first sight and would refrain from falling in love with one another.[37]

Is any more definitive evidence needed to support claims of the ideological potency of scientific language? What the above statements indicate more than anything else is the way in which the metaphor of "natural selection" has insinuated itself convincingly into popular thought, and its success in motivating worldviews and ethical systems throughout the Western world. It is interesting to note that in Geertz' definition of religion, he considers that religious symbol systems establish conceptions about reality and proceed in

> clothing these conceptions with such an aura of factuality that the moods and motivations seem uniquely realistic.[38]

And this is precisely what has happened with "natural selection." This phrase is not *fact*; it is a *metaphor* adopted to communicate a diverse set of observations about the natural world in a manner that is relevant to a general audience. Most evolutionary biologists will rail regarding the inaccuracy of considering "natural selection" as an intentional process, with nature acting as a conscious designer, weeding the bad out of the good, with a mind to ineluctable progress up the evolutionary ladder. Such conceptions are the motive behind a number of "intelligent design" formulations of the evolutionary process, which are frowned upon by the vast majority of biologists. And yet the primary metaphor for evolution is this one of "natural selection," and it is not difficult to see how this metaphor conveys the implicit information of intentionality.

Science may have a great deal to learn from religion. Though religious narrative demonstrably plays a powerful positive role in shaping human lives, it has also provided many striking examples of the potential dangers of untamed metaphor.

It is, furthermore, not difficult to see how this surplus interpretation of intentionality has informed ideology. If nature can serve as the agent of evolutionary progress, then why can't we? Selection is a process with which humans are inherently familiar; it possesses great contextual effect. It draws out such emotionally laden concepts as choice between better and worse, and the possibility of active improvement. It invites human agency. And given such invitations, combined with the potency of the "natural selection" metaphor and its "aura of factuality" (stemming from its association with scientific "fact"), it is not at all surprising that humanbeings should have begun to take the process of selection upon themselves. And from here, it is only a matter of detail

before we are potentially faced with human ideologies, strongly informed by scientific language, which confront us with pressing moral and ethical dilemmas.

Scientific metaphor is, thus, subject to every criticism that has been directed at other traditionally recognized sources of ideology and ethics. In this sense, science may have a great deal to learn from religion. This older sibling of science, after all, has been in the business of shaping ideologies for some time now; and, though religious narrative demonstrably plays a powerful positive role in shaping human lives, it has also provided many striking examples of the potential dangers of untamed metaphor. What modern critiques of religious language teach us can and must be equally applied to scientific language. Although the latter is capable of similarly contributing positive transformative narratives, it can also provide equally damaging worldviews, can offer metaphors that are equally exclusive and non-contextual for minority groups, and can provide equally powerful motivation for human activity that borders on inhumanity. The claim that science can form the basis of a positive new mythos is just as much a claim that science can form the basis of a negative one.

The important realization, then, is that scientifically based ideologies are a function of scientific language, and not a function of scientific fact. Scientific language has the capacity to translate the concepts of science into a form that moves and motivates, that shapes human thought and encourages human activity. But scientific fact itself underdetermines ideology—no unique worldview or ethical system can be generated from the vast library of cold, hard facts. Those various worldviews and ethical systems that are so generated must, therefore, be subject to the same scrutiny that any modern ideology is subject to; there is no exemption granted for being derived from science. A detailed look at scientific language demonstrates convincingly that there is no reason to leave science out in the cold when it comes to the important task of shaping contemporary ideologies and ethics. Science can become an integral participant in this conversation. But it must do so with a willingness to engage non-scientists actively in constructing metaphor that is scientifically accurate *and* generally relevant. And it must recognize also that a basis in scientific fact does not a good ethical system make. Scientific and religious narrative alike must be scrutinized in an effort to provide positive meaning and direction for our species now and into the future.

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Endnotes:

1. Wilson, p. 289.
2. See Mayr; Dawkins.
3. Geertz, p. 90.
4. McFague, *Models of God*, and *Metaphorical Theology*.
5. Ruse; Keller.
6. Goatly, p. 1.
7. Barbour; Ruse; Goatly.
8. Barbour, p. 116.
9. Goatly.
10. Ibid., p. 107.
11. Sperber and Wilson.
12. Brandt, p. 144.
13. Ibid.
14. Ibid.
15. Goatly, p. 152.
16. Steen.
17. Goatly; Lakoff and Johnson.
18. Goatly, p. 150.
19. Ibid., p. 137.
20. Ibid.; see also Sperber and Wilson.

21. Goatly.

22. To my knowledge no such assessment of metaphoric content of academic science writing has ever been done.

23. Goatly.

24. Ruse.

25. Lovelock, *Gaia*.

26. Ibid., p. 10.

27. Ibid., p. 11.

28. Ibid.; Lovelock, *The Ages of Gaia*.

29. Consult the website at URL, <www.magna.com.au/~prfbrown/gaia>, for an excellent resource on Gaia and Gaia-related topics, such as New Age appropriations of the metaphor.

30. Margulis, p. 118. Information in the following discussion of Gaia theory are presented in the final chapter ("Gaia") of Margulis' book.

31. Ibid., p. 123.

32. Kirchner, p.38.

33. See Margulis for a more detailed discussion of the debate within the scientific community on various aspects of Gaia theory.

34. Brandt, p. 123.

35. Margulis, p. 118.

36. Quoted in Howard and Rifkin, p. 45.

37. Ibid., p. 81.

38. Geertz, p. 90.

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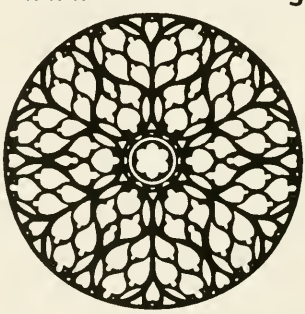
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Evolution and Epiphany: Language in Biological and Theological Perspective

Maurice Lee
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Brief sketches are given, on the one hand, of three "biological" accounts of human language that construe its function in terms of evolutionary adaptation, and, on the other hand, of three "theological" accounts of language that construe its function in terms of human relatedness to God. The theological accounts, when placed into conversation with the biological accounts, are allowed to raise specific critical questions and suggestions for further work, in an attempt to contribute methodologically and materially to the ongoing dialogue between science and religion.

Language and Intellectual Life

That human language—primarily in terms of its abstract structure, interpersonal dynamics, and sociopolitical implications—has been in this century a major focus of philosophical and theological speculation is an observation that hardly needs substantiation.[1] Similarly, language as biology—as a vividly developed and diversified aspect of the functioning of the human organism, embodied in its physical environment—has been much studied in this century by cultural anthropologists and psychologists and, more recently, neurophysiologists and cognitive scientists.[2] However, these vast realms of research on language—philosophy and theology (and related fields) on the one hand, anthropology and neurobiology (and related fields) on the other—have historically interacted relatively little. Philosophers do not often get involved in the "low-level" details of how language is actually implemented in "wet" human brains and varied cultural contexts. And biologists are not notably concerned with arcane questions about the structure of meaning, the nature of representation, and the relation(s) between metaphor and truth. There may have been, and may still be, some good reasons for this "separate but equal" policy. But the idea of interdisciplinary dialogue and exchange among scientists, philosophers, and theologians, as a fruitful way of sharpening conceptual and observational tools and results on all sides, seems increasingly worth considering and testing rigorously.[3] An experiment in this direction is my purpose in this paper. I will sketch the contours of a more-or-less current biological debate—on the role of natural selection in the evolution of the human language capacity[4]—and inquire how a small sampling of more theologically inclined theories of language might interpret, and in turn be interpreted by, the biological debate.

Biological Considerations

The terms of the controversy are set out with clarity by Steven Pinker and Paul Bloom:

> All modern students of language agree that at least some aspects of language are due to species-specific, task-specific biological abilities.... It would be natural, then, to expect everyone to agree that human language is the product of Darwinian natural selection. The only successful account of the origin of complex biological structure is the theory of natural selection, the view that the differential reproductive success

> associated with heritable variation is the primary organizing force in the evolution of organisms.... But, surprisingly, this conclusion is controversial. Noam Chomsky, the world's best-known linguist, and Stephen Jay Gould, the world's best-known evolutionary theorist, have repeatedly suggested that language may not be the product of natural selection, but a side effect of other evolutionary forces such as an increase in overall brain size and constraints of as yet unknown laws of structure and growth....[5]

Any plausible account of the evolution of human language must involve natural selection as the primary mechanism, assert Pinker and Bloom, because "*natural selection is the only scientific explanation of adaptive complexity.*"[6] Language is adaptive and complex in that it is a "system composed of many interacting parts" whose "structure and arrangement suggest design to fulfill *some function*"[7]—a function that has played a crucial role in the ability of the human species to propagate itself and thus, in turn, to ensure the continuing existence and development of the biological (neural and cultural) substrate of language.[8]

To be classified as an *adaptation*, that is, a product of natural selection, language must satisfy two conditions. There must be evidence that (1) "it has evolved (been modified during its evolutionary history) in specific ways to make it more effective in the performance of [a particular] task," and that (2) "the change has occurred due to the increased fitness that results."[9] In other words, if the capacity for language is due to natural selection, then it must serve (or subserve) a specific and recognizable task or *function*—a function from which it must be possible to draw implications concerning biological advantage, that is, increased chances of survival and reproduction. But what *is* that function? This is the heart of the debate.

Pinker and Bloom interpret Chomsky and Gould as saying that language is not an adaptation, because it has no "function" on which selection can operate; instead, it arises more or less epiphenomenally out of the sheer complexity and computational power of the human brain, which serves basically as a general-purpose learning device (Gould) or—whatever else it may be doing—as a theater for the as-yet poorly understood emergent properties that underlie language (Chomsky). Such proposals are vigorously opposed by Pinker and Bloom and many others, for whom the only reasonable perspective is to see language as one among many "specialized biological systems, [all of which] evolved by natural selection."[10]

How is it that clumps of neurons and trains of action potentials came to be (if indeed they are) invested with the power of representation, such that stable, shared structures of association are somehow manifested among three "systems": world—brain—language?

Yet the question of language's function is an exceedingly complex one, in the discussion of which it seems impossible to isolate "scientific" from "philosophical" aspects. The concept of "function" itself is by no means neutral. "Any *functioning* structure carries *implicit* information about the environment in which its function 'works.'"[11] This epistemological principle can be used in reverse: One's construal of the environment in which a particular "function" works influences decisively one's estimate of the function itself, as will presently be seen. The issue is made no easier by the fact that almost none of the neural underpinning for language is understood in any real detail:

at this point, what might be an important constraint on speculation is simply a free variable.[12]

Why should it be that human beings *speak* to one another, intelligibly and incessantly? What is language "used" for? The answer may depend in part on what kinds of "uses" seem important to the one answering. Is this something that can be empirically investigated? Some measure of the matter's depth may be taken by considering some representative proposals (a few out of many) for the biological function of language.

Language as communication

Pinker and Bloom suggest, in what they take to be an "entirely uncontroversial" observation, that "language shows signs of design for *the communication of propositional structures over a serial channel.*"[13] By "propositional structures" they mean groups of symbols that accomplish the identification, classification, and contextualization of people (including beliefs, desires, and behavior), objects, events, and their relationships (including causation). Presumably these "structures" involve interacting references to multiple subjects and objects, with attendant modifiers and predicates, whose joint specification occurs in several degrees of freedom. It is not immediately obvious that these could effectively be transmitted through an essentially one-dimensional ("serial") medium such as that of the voice (and its correlate, the sense of hearing). Yet this, Pinker and Bloom find, is precisely what happens in spoken language, and the *design* of language—in terms of the "universal grammar" that underlies all particular languages—shows signs of its adaptation for the communication task subject to the given constraints. Categories, rules, and structural transformations map the large parameter space with which propositions deal to linear sequences of symbols that are uttered and interpreted according to a shared code. The evolutionary *advantage* of such communication is "obvious":

> By tapping into the vast reservoir of knowledge accumulated by some other individual, one can avoid having to duplicate the possibly time-consuming and dangerous trial-and-error process that won that knowledge.[14]

Pinker and Bloom have come under criticism for their proposal's lack of concreteness when it comes to the process by which language evolved.[15] They posit a history of (vaguely defined) "intermediate grammars," which were less complex or consistent than today's evolved results, but which provided the "bootstrapping" power necessary for the gradual selection of full human language. Bickerton requests details on what such "intermediate grammars" would look like: which categories, rules, or transformations could be impaired or dropped from current grammars while leaving a viable system or sequence of systems. "Anything short of this is mere hand waving."[16] In the end, Pinker and Bloom give impressive evidence for language's "complexity" but can only speculate, and cast doubt on rival ideas, on the matter of language's "adaptation." Their construal of language's function thus fails to contribute materially to their claim that language arose *by natural selection*—and, conversely, the evolutionary evidence pertaining to language provides an insufficient perspective by which to discern its evolutionary function.

Even more fundamentally, the question of the evolution of the capacity for *symbolic representation* itself in any form, including that of speech, is left untouched by Pinker and Bloom. How is it that clumps of neurons and trains of action potentials came to be (if indeed they are) invested with the power of representation, such that stable, shared structures of association are somehow manifested among three "systems": world—brain—language?[17]

Language as power

Is language *uncontroversially* a matter of "transmitting propositional structures," that is, communicating knowledge? Controversy, or the lack of it, seems at least partially to be in the eye of the beholder. In his response to Pinker and Bloom, Charles Catania claims that scientists heretofore have been hampered in developing a convincing evolutionary (selectionist) account of language, because they "have not properly identified the functions served by language"[18]—and, in particular, have failed to realize that the "communicative function did not shape language in the [human] species." He offers an alternative

> candidate for the primary function of language [that] is more fundamental than that of communication: *Language is an efficient way to change another's behavior.*[19]

Communication, according to Catania, is itself simply the sign of a deeper process; it does indeed make an evolutionary difference, but only in that it is used by individuals to influence the behavior of other individuals. Language, as a social phenomenon, "can emerge only in organisms whose behaviors are already sensitive to social contingencies."[20] The key to the development of language is the evolutionary necessity for *discrimination* of behaviors (Can that animal be safely ignored or is it about to eat me?). Discriminative capacities that enhance survival by seeking to shape or be shaped by others' behavior in varying ways under varying circumstances will be selected for, and, Catania suggests, language is one of these. That words *mean* is not so important as—perhaps it is simply a by-product of the fact—that words *do*.

Catania sketches a tentative evolutionary scenario based on his thesis, involving at least two stages: (1) a leader of a group ("probably a dominant male"[21]) maintaining some sort of primitive verbal control over the group's behavior, thus keeping the group coordinated, giving it "a competitive edge," and so (assuming that the leader is reproductively successful!) selecting for increased verbal flexibility and complexity; and (2) the leader's capacity for verbal behavior-shaping expression eventually being replicated in successors and listeners by further selection.

But how is this sort of behavior-influencing behavior different from such things as bird songs, monkey screeches, and bee dances? Or how, in this ancient population, did behavior modification by verbal control escape from the primitive "one-call/one-response" correlation characteristic of nonhuman species? Here Catania makes a sheer conceptual jump:

> The increasing complexity of the vocabulary and its contexts must reach the point at which some calls occur in combination, and their several forms could then evolve further into verbs, nouns, and various modifiers.[22]

It seems, then, that increased grammatical complexity is to be explained not by environmental pressures—but by increased grammatical complexity! Catania provides no insight into how, if language is fundamentally and simply a tool for influencing behavior, the uniquely and lushly developed, arbitrarily extensible structure and sheer range of cognitive and emotional and (not least) behavior-shaping powers of human language came about by means of natural selection. In this case, again, the proposal for language's function, while drawing attention to one of its important dimensions, falls short of illuminating its evolutionary history.

Language as humanness

Derek Bickerton insists that there are features of language that show clearly that it was not *designed* for effective communication of propositions or exercise of power at all. For example, in English (and in other languages, particularly creoles) the marker for the relative clause is often optional. This makes possible "garden path" sentences, which start out by seeming perfectly intel-

ligible—and then become apparent nonsense. For example: *The horse raced past the barn fell.* At first, the sentence's intuitive meaning seems clear: *raced* is the main active verb. But when one gets to the word *fell*, this "garden path" turns out to be a dead end (assuming that the whole sentence is a well-formed one). With a relative clause marker, the intended meaning can be seen more clearly: *The horse that was raced past the barn fell [down].* However, despite the possibility of misinterpretation, the marker is not mandatory: *the book I bought* is as acceptable as *the book that I bought.* Seemingly arbitrary and potentially difficult-to-parse features such as this, Bickerton claims, makes language "quite impossible to explain in terms of social, cultural, or communicative benefits." [23] Indeed, Bickerton's theory of language sees it not as what must *be explained* in terms of putative "functional" requirements and gradual evolution under various selective pressures, but as what *explains* other human abilities and *generated* new and powerful ways of adapting. A single mutation, he proposes, that created a previously nonexistent network between previously unrelated brain structures, gave rise to a "syntax machine" that converted—within several generations—an ungrammatical, limited "protolanguage" into the "superb and infinitely flexible instrument that all of us control today." [24] Language, thus "stumbled into," became the "single determining capacity" [25]—the basis of further selection—that permitted the development of distinctively human intelligence, consciousness, behavior, and culture. It is language that defines humanness.[26]

This, of course, might be dismissed out of hand as the ultimate "just-so" story. (How did language come about? Just *because*!) But Bickerton has effectively disposed of the requirement of explaining language's *function*—in an evolutionary sense—by discarding the necessity of explaining language's *adaptation*. In his view, language has many "functions," [27] but the "need" for these functions arose *from* the preexisting capacity for language, not vice versa. Yet there is a prior problem. Bickerton's argument that language is not an adaptation for communication or social influence depends on its non-optimality—its lack of "good" design for the putative function(s). But, as Pinker and Bloom point out, evolutionary scenarios are not always so reducible: "Tradeoffs among conflicting adaptive goals are a ubiquitous limitation on optimality in the design of organisms." [28] While they would preferably be spelled out more plausibly, it is still the case that there might be many (both repeatable and non-repeatable) reasons that language got "stuck" in certain aspects—blind alleys, local minima—in the course of its development. As much as he rightly emphasizes the *uniqueness* of human language and underscores its importance in forming, framing, and furthering human thought, behavior, and potential, Bickerton has not convincingly demonstrated that the evolution of language cannot be accounted for in terms of function.

The manifold ways in which linguistically skilled brains interact with external objects—including other brains—as part of the story of evolution by natural selection are understood, if at all, only in coarse, and sometimes conflicting, outlines.

Theological Considerations

The proposals just outlined, and their kin, however committed to remaining on the level of "biology," find themselves inevitably touching on aspects of the relation between the organism and its environment—representation, communication, cooperation, competition, influence—on which it is still difficult (though not necessarily impossible) to get a purely biological handle.[29] The manifold ways in which linguistically skilled brains interact with external objects—including other brains—as part of the story of evolution by natural selection are understood, if at all, only in coarse, and sometimes conflicting, outlines. Evidently, the disagreements over language's "function" do not clearly lend themselves, at this point, to purely biological resolution.

To take this line of thinking further, why should the "environment" to which a population of organisms (or one of their functional characteristics) is putatively "adapting" be limited to the physical world?[30] Often, of course, it is seen as methodologically suspect to invoke "supernatural," not to mention *theistic*, descriptions or explanations for phenomena that can be accounted for "perfectly well" on a materialist basis. And it is not to be supposed that, for example, "God," as an explanatory term, could simply settle the biological controversy. Yet accounts of reality may be, to first order, complete in themselves and still be subject to placement in a "hierarchy" of "levels"—levels that are, in the final analysis, not isolatable from each other and, indeed, may influence one another profoundly.[31] And religious adherents, Christians in particular, are not always in the position of having laboriously to justify their belief in a reality beyond the visible. The presence—indeed, the unavoidably intrusive and conditioning presence—of God in and to the world can be assumed[32] and the implications of that assumption mined for their *possible contributions* to (not definitive resolutions of) ongoing debates on other levels. I will pursue the experiment, then, by summarizing three theologically motivated theories of language—in a rough progression.[33]

Language as self-transcendence

Few theologians whose interests include anthropology have explicitly investigated the theological implications of human language as a *biological* phenomenon. One prominent exception is Wolfhart Pannenberg, who connects the development of human language (in terms both of its acquisition by individual children and of its evolution in the species) with the symbolic recognition and manipulation of objects characteristic of human *play* behavior (which opens the individual to the larger world and finds its most complex manifestation in myth and ritual) and, thereby, with "the religious consciousness."[34] By this he means the (usually unthematic) awareness of "totality," the limitless ground against which we recognize and distinguish between finite things, and which for Pannenberg (as, in a different way, for Schleiermacher) functions as an intimation of the infinite God.[35] Language, according to Pannenberg, consists in a symbolic apprehension and representation of things in the world whereby we "open" ourselves self-transcendingly to our

The presence—indeed, the unavoidably intrusive and conditioning presence—of God in and to the world can be assumed and the implications of that assumption mined for their* possible contributions *to (not definitive resolutions of) ongoing debates on other levels.

surroundings, placing ourselves, and that which is not ourselves, in a "total" context. Words carve out particular concepts and objects that can only be understood against their background:

> Every statement about the meaning and nature of a present reality looks beyond what is presently at hand to its context, in which alone the particular thing acquires its due meaning. In this sense, every word that names the nature of a thing by assigning it its meaning gives expression to something "hidden."[36]

Moreover, language is used in *conversation*, in speaking within some sort of community; and in speaking to one another we find that conversations often have a directed and dynamic "life" of their own, transcending and encompassing the individual speakers and pointing ultimately to the "spirit of life as a totality,"[37] the "field" which is actually prior to and makes possible the existence of finite individual bearers of life.[38]

Thus, for Pannenberg, language is more than a tool for communication or power; it manifests the shared human openness to a wider sphere that gives context and meaning to that of which we speak. Of course, no attempt at a neurobiological or evolutionary account of the capacity for *representation* that constitutes that openness is being made here, only an unpacking of the *presuppositions* that underlie the concept of representation. If language involves symbolic representation—a "segmentation" into discrete concepts and objects—of the "world," then there must exist a ground against which the representational figures—in their diversified finiteness—can be distinguished and identified. There are trenchant criticisms that can be directed against the idea of language as *exclusively* a system of representation. Indeed, Pannenberg recognizes that language is *dynamic*—that it is not a static system of fixed associations but "is bound up with 'forms of life.'"[39] And in that this dynamism, this life, characterizes not individual speakers and listeners, but the speaking and listening *community*, pointers may be seen to the "whole" that allows recognition and differentiation of the parts. Language mediates our openness to this "whole" in a way that invites reflection on—and ultimately relation to—the widest sphere, the largest horizon, of all: the infinite and eternal God.

Thus, for Pannenberg, language is more than a tool for communication or power; it manifests the shared human openness to a wider sphere that gives context and meaning to that of which we speak.

Language as co-creation

In no normal usage, of course, does "God" denote anything like "infinite ground of meaning" or "eternal field of the future"—an implicit limitation of theological theories of language that involve only representation. Perhaps one can go further. Although Philip Hefner does not explicitly mention language (in biological terms), his treatment of culture and religion in the context of an evolutionary perspective on human nature would seem to lend itself easily to an extension to language. Hefner's theory of the "created co-creator" attempts to bring the particular picture of the world drawn by modern science to bear on questions of the created order's purpose and humanity's relation to, and responsibility for, the rest of creation. The theory sees human capacities (under the rubrics of "freedom," referring to conditioned decisions and their justifications, and of "cul-

ture," referring to learned behaviors and their interpretations) as the "instrumentality" whereby God enables the whole creation to participate in the divine purposes.

Human beings, representing at their current point of evolution "a new stage of freedom," have been assigned to play a critical role in bringing creation to its fulfillment—its own "emergence" into freedom.[40] Of course, humanity has already—certainly with ambiguous motives and results—extended its influence into an impressively wide range of earthly environments.[41] The urgent task is now to modulate and grow that influence wisely—toward "wholesomeness"[42] and "blessing."[43] Human cultural systems, with their attendant myths and rituals (now joined by scientific practice and knowledge), provide the information necessary to ensure productive congruence between the behavior of human beings and their surroundings.

What function might language have, given such an account of the world and humanity's role? Hefner's flexible use of the term "create" provides a clue. Certainly human beings do not create in the way that God does; but their status as "co-creators" emphasizes (proceeding on analogy from God's character as Creator) their *free* and *intentional* activity. If human beings are co-creators, then perhaps language is the way in which the creation is *defined*—a defining that does not arise automatically out of the creation's intrinsic nature but is given it on the basis of free decision, and a defining that is oriented toward, or cognizant of, its purposes in the context of God's plan.

> Nearly every element of the ecosystem is defined...by the uses the human sector has assigned to it. The very continuation of the ecosystem is significantly affected by *Homo sapiens* and that creature's definition of itself and of its world.[44]

Language, Hefner might say, is a way of *establishing* the world, not in an ontological, *ex nihilo* sense, but as a sphere of responsible and directed human action.

A precursor to this idea might be found in the Yahwistic account of creation (Genesis 2–3), in which God brings the animals to the man in order that they might be named:

> So out of the ground the LORD God formed every animal of the field and every bird of the air, and brought them to the man to see what he would call them; and whatever the man called every living creature, that was its name. The man gave names to all cattle, and to the birds of the air, and to every animal of the field; but for the man there was not found a helper as his partner.
>
> (Gen. 2:19–20)[45]

In his commentary on Genesis, Claus Westermann writes of this passage:

> The meaning is not, as most interpreters think, that the man acquires power over the animals by naming them. ...[b]ut rather that the man gives the animals their names and thereby puts them into a place in the world. ... By naming the animals the man opens up, determines and orders his world and incorporates them into his life. The world becomes human only through language.[46]

Furthermore, the naming is purposeful: in naming the animals, the man is pursuing God's desire that he have a companion.

> God brings the animals to the man: this procession gives expression to the intention of God in making the animals; it implies that it is the man who finds out and decides what sort of helper corresponds to him.[47]

With such a concept of language, consideration shifts from that of humanity's *representation* of the world (and wider contexts) to that of humanity's active (free and intentional) *involvement* with the world—and with God. Yet this account still leaves the link between *naming* and *responsibility* unclear. Why should it be that, when the world has been "defined" by language, humanity's "involvement" with the world on the basis

of language is meant to be oriented toward "wholesomeness" and "blessing" for all creation—instead of simply toward competitive power and self-aggrandizement (as in the Tower of Babel story, Genesis 11)? There is room for yet another step in seeking the theological significance of human language.

Language as moral engagement

This third step is taken, in vigorous form, by Nicholas Wolterstorff. Taking his cue from the speech-act theory initiated by J. L. Austin, Wolterstorff sees human speaking as a way of *performing* actions—what Austin called *illocutionary* acts, among which are asking, answering, informing, assuring, warning, announcing, promising, and identifying.[48] The act of speaking, that is, of uttering words—a *locutionary* act—may *count* as one of these illocutionary acts.

> And what is it, for one's performance of one action to *count* as one's performance of another? My own conviction is that there is no more fundamental question posed by human discourse than this. How can it be that by uttering the little word "Guilty," someone condemns another to be shot at dawn?[49]

Wolterstorff states explicitly that "speech actions are not, in their nature, a species of exerting influence over someone [pace Catania], nor a species of communicating or expressing one's inner states"[50] (pace Pinker and Bloom). Instead, he suggests, speaking—using language—is the taking of a position, vis-à-vis one's fellow persons, in which one has acquired certain "rights and duties." To speak is "to take up a normative stance in the public domain."[51] The function of language, for Wolterstorff, is intrinsically bound up with issues of moral accountability—indeed, language is a way of establishing and defining moral accountability. A speech act, given normal circumstances and all other things being equal, places the speaker under certain obligations—to tell the truth, to keep the promise, and so on—and the hearer(s) under certain obligations as well—to answer the request, to heed the warning, and so on. Of course, illocutionary acts may in fact, for a variety of reasons and under a variety of circumstances, fail or be undermined, so that the normative standings that would have otherwise been assigned do not "take." Still, Wolterstorff insists, the fundamental texture of human language, human speech action, is moral and ethical, and that texture qualifies our relation to the rest of creation: "By the acquisition of normative standings, we take up the material world into our service."[52]

Moral subjectivity is formed in* communal *and* narrative *mode, and Wolterstorff might agree with the thesis that the social dynamic of language is at least partly constitutive of the development of human identity in a moral environment.

Pannenberg criticizes speech-act theory, though not specifically Wolterstorff's use of it, on the grounds that language has primarily to do with the *representation of meaning* and only secondarily with *achieving ends*—that is, with performing actions. Indeed, since the concept of "action" requires an acting subject, and since human subjectivity—in terms of the unity of the ego, the "I"—is only formed in time through the process of living, "it is presumptuous for individuals to want to produce the whole of life by their own action."[53] As mentioned already, Pannenberg maintains that such phenomena as conversations—which depend on "an object of shared interest that creates a common ground and therefore communication"[54] and then go on to take "a life of [their]

own" [55]—show that language, far from providing a basis on which we might be "sovereignly" acting subjects, lifts us out of ourselves into the unpredictable realm of the "spirit." This might be true, as far as it goes, but actually fails to come to grips with Wolterstorff's particular use of the speech-act concept. For to take up a "normative stance" in the public domain is not—as the words themselves might unfortunately suggest—to pit one's atomistically and previously defined subjectivity over against the world; rather, it is to accept an essentially *intersubjective* and *historical* construal of one's identity—as related to God and to others in the story of one's life. Moral subjectivity is formed in *communal* and *narrative* mode, and Wolterstorff might agree with the thesis that the social dynamic of language is at least partly constitutive of the development of human identity in a moral environment.

Biological Language in a Theological Environment

What these various theological proposals, building on one another, have in common is the idea that language reflects shared human relatedness not just with conspecifics or the natural order, but also and fundamentally with God—as the ultimate ground of meaning, the paradigmatic creator and definer, and the source of moral norms. Under consideration here, undoubtedly, are notions such as "representation" and "relation," that have been greatly extended beyond their normal biological uses. Have they been stretched too far? Has biology simply been left behind? Is the apparent tension between seeing language as God-directed and language as an adaptive product of natural selection insurmountable? What possible relation could theological (Jerusalem) have with biological (Athens) theories of language?

The findings to this point may be summarized, somewhat aphoristically. If language is adaptive communication (Pinker and Bloom), then the representation implicit in that communication points toward the shared world and beyond to an infinite basis of meaning (Pannenberg). If language is adaptive power (Catania), then the direction of linguistic influence toward specific targets presupposes the intentional linguistic "creation" of a world in which targets exist—a co-creation possible because of the original Creator (Hefner). If language is the basis of adaptive humanness (Bickerton), then "humanness" involves the moral agency—ultimately vis-à-vis God—established by language (Wolterstorff). Of course these statements, as they stand, are much too definitive. A great deal of elaboration would be required to establish the suggested connections on firmer ground. But even in rough form they may provide a suitable backdrop for some issues arising from this attempt at convergence between biological and theological theories of language.

In order for a character to be an adaptation, its function must confer, or contribute to conferring, an increased probability of survival and reproduction. Does a relation to God increase the probability of survival and reproduction? The answer is by no means intuitively obvious.

Questions about representation

In the first place, it would seem that more sophistication is called for in the use of the idea of "representation." To repeat the basic question: How does the connection—

fundamental to language—between an object or concept in the "world" (or an internal state!) and its "symbol" as a word or sentence arise? At first glance, it would seem straightforwardly unproblematic to construe language, as Pinker and Bloom do, as a matter of symbolic representation. But this is a non-trivial biological question that, as has been noted, opens up important philosophical and theological implications in multiple directions. On the one hand, it is not at all easy to state precisely—even in principle—how representation might be "done" in the brain and therefore how it might have "developed" through natural selection.[56] More work needs to be done here. On the other hand, the very concept of linguistic representation—when pressed to its logical conclusion—seems to lead to the threshold of a territory where theistic assumptions and "God-talk" no longer seem foreign, and where that which is represented is necessarily a dynamically *social* world that transcends and contextualizes the individual user of language. The "environment" in which "representation" is taking place may have dimensions as yet unexplored in standard evolutionary biology.

Representation as an aspect of the function of language can hardly be dispensed with. But, while the idea of representation is essential, it is not perforce the only way available of thinking about language. Thus, a further task: for a more adequate theory, the idea of representation must be integrated, biologically and theologically, with other means of construing language.[57]

Questions about adaptation

Secondly, if the "function" of language involves human relatedness to God, then the concept of "adaptation" itself, at least in this connection, is open to challenge. In order for a character to be an adaptation, classically considered, its function must confer, or contribute to conferring, an increased probability of survival and reproduction. Does a relation to God increase the probability of survival and reproduction? The answer is by no means intuitively obvious—at least on the Christian account of God, which sees relatedness to the God of Jesus Christ as potentially involving commitments and behaviors that decidedly do *not* foster survival and reproduction. If, indeed, in language may be found—even from its evolutionary beginnings—human beings' self-transcending openness to God, their definition of the world in accordance with God's purposes, and/or their acquisition of moral rights and duties before God and each other, *as well as* their capacity to communicate propositions or influence behavior or generate culture, then the concept of evolutionary adaptation could well be more complex and less unambiguous than might at first be supposed.

Controversy remains over the *primacy* of adaptation as a driving force of evolution and of the adaptationist "stance" in evaluating biological data from an evolutionary perspective.[58] A wider context for this debate can yet be imagined. If the "struggle for survival" is not the last word on earthly existence, if the often painful and deadly contests among genes, organisms, and populations that seem endemic to the biological drama can validly be interpreted in the light of the assertion that "the creation waits with eager longing for the revealing of the children of God; for the creation was subjected to futility, not of its own will but by the will of the one who subjected it, in hope that the creation itself will be set free from its bondage to decay and will obtain the freedom of the glory of the children of God,"[59] then the centrality of adaptation as a feature of the history of life is dramatically relativized. After tracing part of the history of the debate over adaptation, Burian points out that

> the deep and complex biological issues that occasioned the debate remain: does selection operate at many levels, producing many levels of adaptations? If so, how does this affect the nature of adaptive processes and of adaptations?[60]

The question can be recast in the light of the relationship to God manifested by language: What "processes" *other than* (and not always and necessarily *opposed to*) selection operate at different levels, producing many levels of effects, including but decisively not limited to adaptation?[61]

Questions about ethics

Thirdly, if language—even as an evolutionary phenomenon—reflects our standing (and acting) as moral agents, then perhaps this is a sign that morality is an *irreducible* aspect of the nature of reality and must be taken into account, not simply by explaining it *away* in terms of evolutionary advantage and adaptation (for example) but as *part and parcel* of those concepts.[62] I will not repeat the symphony of arguments conducted by Murphy and Ellis, for example, against the possibility of "reducing" ethics to anything else. Instead, I will engage Dennett's claim that the only realistic and potentially productive account of morality is based not ultimately on the character of God and God's word, but on reason and nature—that is, on a picture of the world painted from a strictly evolutionary palette.

> As Darwinian thinking gets closer and close to home—where we live—tempers run higher, and the rhetoric tends to swamp the analysis. But sociobiologists, beginning with Hobbes and continuing through Nietzsche to the present day, have seen that only an evolutionary analysis of the origins—and transformations—of ethical norms could ever properly make sense of them. ... Ethical decision-making, examined from the perspective of Darwin's dangerous idea, holds out scant hope of our ever discovering a formula or an algorithm for doing right. But that is not an occasion for despair; we have the mind-tools we need to design and redesign ourselves, ever searching for better solutions to the problems we create for ourselves and others.[63]

Dennett scorns appeals to a nonexistent God, or the Bible, or other sacred texts or traditions, for morally authoritative judgments, and subsequently finds that his preferred brand of evolutionary "realism" provides a context for tracing the development and interrelationships of various ethical systems—but no firm basis for moral authority of any kind, except, perhaps, that which can be expressed in terms of "solutions" to "problems" found by "mind-tools." Language, of course, is among the needed "mind-tools," whose emergence presented to human beings

> a technology that created a whole new class of objects-to-contemplate, verbally embodied surrogates that could be reviewed in any order at any pace. And this opened up a new dimension of self-improvement—all one had to do was learn to savor one's own mistakes.[64]

With the tool one can accomplish, or attempt to accomplish, the task—even if part of that task involves the use of "*conversation-stoppers,*"[65] arbitrary rules that squelch moral debate in favor of decisive action. But if language is *itself a form of moral engagement*, then the task has been started even before the tool has been picked up. If by speaking we posit and take normative stances in the public domain, then in so doing we are not, in the first place, defining or debating moral norms: we are *submitting* to preexisting norms and being ourselves *directed*, communally and authoritatively, by them. Whence arise those norms (or standards or conventions)? It would be beyond the scope of this paper to demonstrate (if it were possible) that the most parsimonious "answer," with the most explanatory power, to that question is "God"; but persistent proposals to the contrary still fail to convince.

Language and Trinitarian Life

The—however "adaptive" or otherwise—relatedness to human beings, to the rest of creation, and to the Creator reflected in language finds much deeper resonance in the distinctively Christian vision of God. For the God worshipped by the followers of Jesus Christ

is self-revealed as *constituted* by self-giving relatedness,[66] by the "mutual interiority" of the persons known to us as Father, Son, and Spirit.[67] And in the Biblical testimonies the (economic, and by extension ontological) relationships among the Trinitarian persons are imaged in terms of their speaking with one another and with others.[68] God's unsurpassable presence—indeed, indwelling—with humanity, in fulfillment of the ancient promises, is described, famously, as the *Word*.[69]

And, finally, the eschatological community is portrayed in terms of (*inter alia*) never-ending *praise*.[70] Might it not be compelling to take up the suggestion that human language provides a faint analog of the richness of the divine life—or, more properly, that the divine life is *imaged* when human community is established through language?

> But now you must get rid of all such things—anger, wrath, malice, slander, and abusive language from your mouth. Do not lie to one another, seeing that you have stripped off the old self with its practices and have clothed yourselves with the new self, which is being renewed in knowledge according to the image of its creator. In that renewal there is no longer Greek and Jew, circumcised and uncircumcised, barbarian, Scythian, slave and free; but Christ is all and in all!
>
> (Col. 3:8-11)

To whatever extent evolutionary theory provides a faithful description of the history of life on Earth (or elsewhere), language is surely an element of that story, subject to the same constraints, instantiated in the same physical, chemical, and neural "wetware" that provides the substrate for other biological capacities and phenomena. But the "functionality" of language transcends its place in the biological framework, and would (whether the encounter be resisted, ignored, and derided, or welcomed and celebrated) take those who speak into the presence of the living God.

> The heavens are telling the glory of God;
> and the firmament proclaims God's handiwork.
> Day to day pours forth speech,
> and night to night declares knowledge.
> There is no speech, nor are there words;
> their voice is not heard;
> yet their voice goes out through all the earth,
> and their words to the end of the world.
>
> Let the words of my mouth and the meditation of my heart
> be acceptable to you,
> O LORD, my rock and my redeemer.
>
> (Ps. 19:1-4, 14)

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Endnotes:

1. Randomly: "In our time philosophy 'has concerned itself with language as never before in its history'" (Pannenberg, *Anthropology in Theological Perspective*, p. 340, quoting E. Heintel). "Modern philosophy is dominated by a concern with language" (Blackburn, p. v). "One of the central concerns in contemporary theology and biblical studies has been the interest in linguistics and hermeneutics" (J. B. Torrance, in his foreword to Thiselton, p. xi).

2. Enthusiastically: "The science of language…has seen spectacular advances in the years since [the birth of the field of cognitive science]. There are many phenomena of language that we are coming to understand nearly as well as we understand how a camera works or what the spleen is for" (Pinker, p. 17). The real story is somewhat more complicated, as I hope to make clear.

3. See Peters; Murphy and Ellis.

4. It should be noted that I am here presupposing neither commitment nor opposition to the proposal that natural selection is the explanatory principle of the history of life. The thesis has great strengths. But the eagerness with which some writers on evolution seize on the "power" of purely natural selection to "explain" complexity and (apparent) design—and thus exclude theistic viewpoints (Dawkins; Dennett)—is more than a little naive. The concept of "explanation" itself deserves a more nuanced and sophisticated treatment than it suffers at the hands of such authors (cf., e.g., Swinburne).

5. Pinker and Bloom, p. 708.

6. Ibid., p. 709; emphasis in the original.

7. Ibid.; emphasis added.

8. Whatever that substrate might be and however it might work, the details of which are by no means clear.

9. West-Eberhard, p. 13, where "fitness" simply means a comparatively better ability to exist long enough to reproduce.

10. Pinker and Bloom, p. 726.

11. Dennett, p. 197. Emphasis in the original.

12. Pinker gives a popularly oriented (and at points optimistically speculative) summary of the neuroscience. And yet, concisely: "What is [still] pretty much a mystery at this point is how linguistic rules and representations are neurally instantiated—that is, how physical structure in the brain could make possible the combinatorial regularities discovered by linguistic research. In fact, other than certain aspects of low-level vision, I know of no success at relating systematicities of mental representation to the details of neural architecture" (Jackendoff, pp. 737-738). Actually, it is not clear how even exhaustive knowledge of the neurophysiology of language would affect an estimate of its function, biological or otherwise.

13. Pinker and Bloom, p. 712; emphasis added.

14. Ibid.

15. See the commentaries accompanying Pinker and Bloom.

16. Bickerton, p. 73.

17. Deacon provides a slightly more daring reading of the relation between biology and symbolic representation, suggesting that the representational power of language could only arise with the development of the prefrontal cortex, which goes beyond making direct correlations between external (environmental) stimuli and internal brain states to engage in "higher-order sequential or hierarchic associations" among brain areas (p. 665). But how do interactions between brain areas give rise to symbols? As indicated above, our ignorance about how things work makes our "stories" about how things got to be the way they are dangerously Kipling-like ("just-so"). Some of the difficulties, often blithely ignored, associated with coming up with a plausible account of the evolution of representation are nicely summarized by Deacon (pp. 667-668). From a different direction, Hacker asks some salutary—though not insoluble—questions about the usually unmentioned subjects of the alleged "representations," "mappings," and "encodings" and "decodings" that are supposed to be going on inside the brain. Who or what is doing all this work—and according to whose conventions?

18. Catania, p. 730.

19. Ibid.; emphasis added.

20. Ibid.

21. Ibid., p. 731.

22. Ibid.

23. Bickerton, p. 37.

24. Ibid., p. 85.

25. Ibid., p. 7.

26. Bickerton's idea here shows parallels to Jaynes's suggestion that consciousness and culture are the consequences and not the prerequisites of language: "Each new stage of words literally created new perceptions and attentions, and such new perceptions and attentions resulted in important cultural changes which are reflected in the archaeological record" (p. 132). A similar concept is described, more graphically, by Dennett, in his metaphor of the "Tower of Generate-and-Test," which arranges organisms hierarchically according to their ability to foresee consequences and plan strategies for their future actions. "There is one more embodiment of that wonderful idea, and it is the one that gives our minds their greatest power: once we have language—a bountiful kit of mind-tools—we can use these tools in the structure of deliberate, foresightful

generate-and-test known as science. All the other varieties of generate-and-test are willy-nilly" (p. 380).

27. Bickerton, p. 11.

28. Pinker and Bloom, p. 717.

29. See the various contributions to Keller and Lloyd for the ongoing struggles to make biological "sense" of some of these concepts, as well as others such as "altruism," "fitness," and "progress."

30. Cf. Jenson's caustic invocation of the concept: "A theologian already must have some problem with this phrase: 'adaptation' to what? If our culture's standard association of terms is to be followed, 'adaptation' is to the 'environment,' a term devised on purpose to bracket out the reality of God" (p. 117).

31. See Murphy and Ellis.

32. See Plantinga.

33. Perhaps in parallel with what some see as the historical shift from "modern" to "postmodern" theories of language (see Murphy).

34. Pannenberg, *Anthropology in Theological Perspective*, p. 361.

35. Pannenberg, *Systematic Theology*, Volume 1.

36. Pannenberg, *Anthropology in Theological Perspective*, p. 395.

37. Ibid., p. 376.

38. Robert Jenson's interpretation of language is similar in form, although he prefers to emphasize the temporal dimension: "Language is the location of our openness to the future. It is only because reality is not there for us in its brute self merely, but is there for us in our words to each other about it, is there interpreted and so interpretable, that the world as it has come to be is not final for us, that we are able to will and evoke what is not yet" (Jenson, p. 56). Thus the open, yet-to-be, boundless "field" of the future is the context that gives meaning to words. Further, also in line with Pannenberg, Jenson finds that language posits a communal and historical world: "By our words to each other, by our mutual address and response, we create a shared life, a life that is neither just my life, or your life, but our life. In that shared life, what comes from you is to me a new possibility, a new future, just in those ways in which you are in fact different from me" (Jenson, p. 41). See Pannenberg, *Systematic Theology*, Volume 2; Welker.

39. Murphy, p. 114.

40. Hefner, p. 32.

41. Hefner has relatively little to say about the rest of the (non-earthly) cosmos, and what he does say is vague and unfocused. What, for example, is the significance of humanity's "stretching" activity (p. 47), Hefner's metaphor for cultural development considered together with its effects in the terrestrial context, on, or from the perspective of, a quasar 15 billion light-years distant?

42. Hefner, p. 155.

43. Ibid., p. 237.

44. Ibid., p. 119.

45. All scriptural citations are from the Bible, New Revised Standard Version.

46. Westermann, pp. 228-229.

47. Ibid., p. 228.

48. Austin, pp. 98-99.

49. Wolterstorff, p. 78.

50. Ibid., p. 75.

51. Ibid., p. 93.

52. Ibid.

53. Pannenberg, *Anthropology in Theological Perspective*, p. 367.

54. Ibid., p. 370.

55. Ibid., p. 372.

56. See Hacker. Cf. Kanerva for one among many mathematically rigorous attempts to outline a "theory" of memory that merely ignores the problem of how sequences of binary digits or collocations of adjustable synaptic weights might mean

concepts, propositions, feelings, or experiences.

57. See Murphy.

58. See Burian; West-Eberhard. The phenomenon of altruism retains its premier rank among "problems" for evolutionary theorists (see the relevant sections of Keller and Lloyd; Dennett; Hefner; and Murphy and Ellis)—not in the sense that it is an insoluble barrier to selectionist accounts that depend on the force and ubiquity of competition (the "struggle for survival"), but in that construing it consistently as an adaptation brings to light numerous ambiguities, conceptual slippages, and odd implications that are still being debated and worked through.

59. Rom. 8:19-21.

60. Burian, p. 12.

61. Of course, another question can be asked from the reverse direction: If relatedness to God is in some way (or various ways) an inescapable aspect of human existence, then can one speak intelligibly of neurobiological substrates for that relatedness? What is happening in our brains when we pray? Perhaps nothing "special"—but as yet our answer must still be ignorant, if curious, silence.

62. Murphy and Ellis.

63. Dennett, pp. 493, 510.

64. Ibid., p. 380.

65. Ibid., p. 506.

66. See Moltmann.

67. Volf, p. 128.

68. For example, Matt. 4:16-17, Luke 10:21-22, John 17, Acts 13:2.

69. John 1, Heb. 1:1-3. "In the mind of the theologian of the Prologue [to the fourth Gospel] the creative word of God, the word of the Lord that came to the prophets, has become personal in Jesus who is the embodiment of divine revelation" (Brown, p. 524).

70. Revelation, passim.

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Economy, Technology and the Environment: The Islamic Middle Way

by Imad-ad-Dean Ahmad

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Dr. Ahmad considers some specifics of the ways in which the Qur'an, the Prophetic traditions and Islamic law lead toward a path of moderation between extremes, in terms of both belief and behavior: in favor of free markets, but with property rights clearly defined to prevent fraud and unfairness; in favor of technology, but not materialism; and with a concept of trusteeship of the environment that accomodates both development and stewardship.

A certain school of commentators in the media try to give the impression that Islam is the religion of extremism. Islam is the religion of moderation in almost all things. It is not moderate in its monotheism. And as Rose Wilder Lane points out in *Islam and the Discovery of Freedom*, the Prophet was not moderate on cleanliness, insisting that prayers are invalid unless the worshipper is clean when reciting them.[1] Islam would agree with Senator Barry Goldwater, as well, that moderation in the pursuit of justice is no virtue. With notable exceptions, then, Islam is the religion of moderation regarding most things, including the three subjects of this talk.

Regarding economy, technology, and the environment, what are the extremes that Islam can be said to take a moderate position between? When it comes to economy we can look at the extremes of conspicuous consumption on the one hand, and asceticism on the other. Regarding technology, we can look at Prometheanism versus the Luddite attitude. I refer here to an interpretation of the Greek myth of Prometheus in which human technology constitutes a rebellion against God (or the gods, in the original Greek story) and is raised to the status of a new god for worship. At the other extreme, the Luddites were people who, at the time of the Industrial Revolution in England, were so opposed to the developing technologies that rendered their jobs obsolete, that they smashed the new machines put on the market and destroyed them. They have their analogs in today's world, as well.

Then, on the subject of ecology, we also have extremes. On one hand is the view of human dominion over the earth. And at the other extreme, a kind of religion of Earth-worship, in which the Earth is viewed not only as an organic body, as in the famous Gaia hypothesis,[2] but even as a goddess to be worshipped.

Before I get into the discussion of how Islam takes the moderate position between these extremes, I want to mention another element that is constantly touching on all of these issues: rampant materialism and the absence of spirituality from so much of the contemporary worldview. This worldview developed and evolved in the West and came into the form that we see today through a critical point in French Enlightenment at the time of the French Revolution. The myth that religion and science are inherently opposed to one another has become the dominant view today. It came about because of an accident of Western history that I have

dealt with in detail in my book, *Signs in the Heavens*. The way that Europe emerged from the Dark Ages was through contact with Islamic science and religion. These two were associated together in the minds of the European Church, which attempted the suppression of both and branded anyone who embraced the sciences that came out of the Muslim world to be in opposition to the Church's teaching, in opposition to true religion, and in opposition to God and to spirituality.

This crisis provoked three reactions in the West. Some people accepted that dichotomy and chose materialism over spirituality, or chose secularism over faith. Others chose faith over secularism and, in rejecting science, became the progenitors of today's fundamentalists. There was also a third group, which attempted to reconcile Christianity with the sciences, and was the source of the Catholic Renewal and the Protestant Reformation. But this tension, this struggle, continued and got worse; and it got especially severe during the French Enlightenment. During that period the reaction against the old ways of doing things became quite extreme. It became extreme in many respects, including a transformation in the perception of the very nature of science.

The way that Europe emerged from the Dark Ages was through contact with Islamic science and religion. These two were associated together in the minds of the European Church, which attempted the suppression of both.

Ancient scientists looked upon reason as the dominant way of knowing the world. The Muslim progenitors of modern science sought a balance between reason and empiricism. The French Enlightenment produced people who looked at empirical data as the primary way of knowing the world. And they would turn towards the encyclopedias, trying to accumulate as much data as they can. The perception was becoming prevalent that knowledge consists of nothing more than the immense collection of data points about the material world. The idea of some higher level of knowledge, some level of wisdom, was beginning to vanish from the understanding of how reality is to be perceived.

But more important and more relevant to our subject is the arrogance that emerged from the humanism of the French Enlightenment—a view that the human being is so perfectible that solutions to all problems can be designed by humans themselves, leading to the concept of social engineering. Notice the connection to the mechanistic view of the world. Before the French Enlightenment, this view was restricted to the world of physics; people had begun to view the material world as a world of mechanisms. During the French Enlightenment, however, they began to carry over this understanding of the inanimate world of physics into the animate world of biology. Biology began to be seen in terms of mechanisms. And then, in Darwinism in its extreme form, even the evolution of life itself was viewed as a mechanism—just an accidental consequence of mechanical forces at play, with no design at all. With the exclusion of God, the ultimate source of universal design, from the picture, the only source of design in the material world had to be human beings, and the presumed human ability for social engineering was put forward to replace any attempt to understand Divine Law in the governance of human affairs. In the post-modern period, even the human ability to design is rejected. We end up with a total subjectivism that says that there is no objective reality at all, and there is almost no point in trying to resolve any problems because they are fundamentally unsolvable.

This idea that the principles of engineering that work so well in physical mechanics can be applied to society brings us to many of the problems that our society has to confront today. In particular, I want to emphasize the difference between rule-based systems and command-based systems. Polytheism is a command-based view of the divinity. It purports that there are gods who go around giving orders, and that what we see in the natural world about us and in our spiritual world is nothing more than a playing out of the orders of these conflicting gods. It is opposed to the monotheistic view, that there is a singular Creator who has harmonized all of the cosmos in accord with His set of rules, and it is these rules rather than capricious commands that determine how the system operates. Now, as it turns out, this opposition between rule-based and command-based systems becomes very important in modern thinking, not only in the theological area but in the areas having to do with engineering, with evolution, with politics, and with economics—all kinds of processes.

I want to begin with the Holy Scripture of the Qur'an and go back to a fundamental question before we get into the details of economics, technology and ecology. Before we discuss those topics, I want to ask a primary question that we have to address : Why are we here? I don't mean why are you here in this hall and why am I here giving this lecture (although in a sense I suppose these are subsidiary questions to the broader question). Why are we here at all? What is humanity's purpose on Earth? Here is the explanation we find in the Qur'an. This is a translation by Abdullah Yusuf Ali, except that I have restored the Arabic word *khalîfa* for Ali's translation of "vicegerent." I do this for a number of reasons, foremost because this word, *khalîfa*, has been somewhat misused historically, and I think it is good to remind ourselves of the context of word, so that we who are Muslims might appreciate its precise meaning.

> Behold thy Lord said to the angels,
> "I will create a *khalîfa* on earth."
> They said, "Wilt Thou place therein
> one who will make mischief therein
> and shed blood whilst we do
> celebrate Thy praises and glorify
> Thy Holy Name?" Allah said, "I
> know which ye know not.'"
> (2:30)

The word *khalîfa* comes from the root meaning "to become a successor." In this form, *khalîfa* more properly means a trustee, someone who is entrusted with something. So God is saying, "I am creating the earth and I am going to create a being to whom I am going to entrust it, to take care of it." The implication is that God is going to give this being those God-like powers of freedom of will in order to be able to be the trustee. You can't be the trustee of something unless you are given the ability and the freedom to make decisions about it. And God says, "I am going to create a creature and I am going to give this creature the ability and the freedom to make decisions about what to do with My Earth that I have created. And I am going to place this creature there." And the angels, who themselves have no freedom of will and can do only what God has ordered them, do not understand. So they ask, "You say that You are going to place a creature as *khalîfa* who can do evil things and who can shed blood on this beautiful earth that You have created, while we, the angels, we just celebrate Your Holy Name? We do whatever You want us to do, whatever is good." The implication is, why not put the angels in charge of the earth? But God's response is, "I know what you do not know."

> And Allah taught Adam the nature
> of all things. And Allah placed them
> before the angels and said, "Tell me
> the nature of these if you are right."
> (2:31)

Now, Adam, the prototype of humankind, is given, along with free will, the ability to acquire knowledge and to understand. And so God has given Adam the knowledge of the nature of things. And He turns to the angels, and says, "If you think that a being

without free will can serve as my trustee, tell me the nature of things."

> The angels said, "Glory to Thee, of knowledge we have none, save what Thou hast taught us. In truth it is Thou who art perfect in knowledge and wisdom."
>
> (2:32)

The angels, of course, do not know the nature of things. They can only know what God directly reveals to them.

> He said, "O Adam, tell them their natures." When he told them, God said, "Did I not tell you that I know the secrets of heaven and earth and I know what you reveal and what you conceal?"
>
> (2:33)

God is saying that Adam is given freedom of will as a necessary element for being the trustee, in order to be able to acquire the knowledge that he needs.

And now the crunch:

> And behold We said to the angels, "Bow down to Adam," and they bowed down. Not so Iblis. He was haughty and refused and was of those who reject faith.
>
> (2:34)

Iblis, as he is referred to here, is the Devil, not an angel, according to Islamic theology. I know that in Christian theology he is a fallen angel. In Islamic theology, he is a *jinn*, a kind of another creature that God created. And like Adam, a *jinn* has free will. This particular *jinn* was very arrogant. He would hang around with the angels because he thought he was of very exalted status, an attitude which, in another passage, causes God to ask to him, "Why did you not bow down when I told the angels to bow down?" His arrogant—and materialistic—reply is, "Because I am made of fire and he is made of clay," as if material substance had any consequence or significance for this issue.

The point of the present passage is that God told the angels, these perfect creatures who obey God exactly, to bow down to this creature He created who could conceivably make mistakes, who is weak, but who had that marvelous gift of freedom of will. So, what God was saying is that human beings are created not *below* the angels, but *above* the angels.

Now, the reason this is important is because it touches on all the topics we are considering today.. Human beings have a purpose on Earth: we are the *khalîfa*. And when I say we are the *khalîfa*, I mean each individual human being, male and female, is God's representative, God's vicegerent on Earth, the one to whom Creation has been entrusted. We are here with a mission. As the Blues Brothers say in the movie of the same name, "We are on a mission from God." Well, we are.

Every one of us is on a mission from God—if we can just remember it. The name for a human being in Arabic, and it is used in the Qur'an, is *nâs*. And *nâs* is close to a root word in Arabic meaning "he forgot." The Qur'an repeats over and over again that it is not that human beings are evil. Muslims do not believe that human beings are born evil; we believe that human beings are born weak. We have a tendency to forget why we are here. The reason we are given religion is to remind us. That is the reason we are given all of these rituals. Some people will say, "I can see why religion would have ethical guidance, but what's with all of these rituals?" Well, the rituals are there because we need reminders. Muslims will pray five times a day, fast one full month out of the year, and give 2 1/2% of their wealth to charity. We do these things to keep reminding ourselves why we are here, because otherwise we are weak and we forget. We get seduced by this material world, which was created to be a stage upon which we act; and instead we elevate it to the be-all and the end-all, which it is not.

Economics

It should be obvious that whatever Islam has to say about economics, technology, and ecology, comes in the form of guidance for us to perform our duties as the *khalîfa*, to take care of God's Creation. I say "take care," but I don't want to translate *khalîfa* as

"caretaker." That is too limited a concept. The gospels report that Jesus (peace be upon him) told the story about the master who gives each of his servants a number of talents to take care of. One of them wraps his portion up and buries it in the earth. But the master is not satisfied with that action, even though the talent has been protected. What he meant was for the servant to take care of it—not just to protect it, but to make use of it, be productive with it, get something out of it. This is the Muslim view of what it means to be the *khalîfa*.

Wealth

Therefore, when we look at Islamic economics, we find that the Qur'an's view and the view of the Prophet himself, as well as of Islamic law, is neither asceticism nor is it conspicuous consumerism. Human beings are not to deny the benefits of this world, nor are we to allow wealth to dazzle us into forgetting our obligations to God. It is the middle course. The attitude of the Qur'an toward economic wealth is that it is, in itself, neither good nor bad. What makes wealth good or bad are the answers to two questions: How did you earn it? What are you going to do with it now that you have it? If you acquired the wealth in harmful ways, by robbing from people, by defrauding people, by engaging in unfair, exploitative practices, or selling products that diminish or destroy the user, your wealth is of no benefit to you. It is a chain around your neck. In the Prophetic traditions (*Hadîth*) it is reported:

> Allah's Apostle said: "Whoever usurps the land of somebody unjustly, his neck will be encircled with it down the seven earths [on the Day of Resurrection]."[4]

If, instead, you acquire wealth in a *halâl* (permitted) fashion and you spend it for a good purpose—and good purpose can be for your own improvement, for the benefit of your family or of the society or the community, for something that is helpful or positive or constructive—then it is a good thing.

The problem with wealth, unfortunately, is that it tends to dazzle us. We become worshippers of Mammon. Islamic law has produced very specific means of keeping Islam as the middle path. The Qur'an has a verse that says of the Christian ascetics:

> We sent after them Jesus the son of Mary and bestowed on him the Gospel: and We ordained in the hearts of those who followed him Compassion and Mercy. But the monasticism which they invented for themselves We did not prescribe for them: [We commanded] only the seeking for the good pleasure of God; but that they did not foster as they should have done.
>
> (57:27)

The attitude of the Qur'an toward economic wealth is that it is, in itself, neither good nor bad. What makes wealth good or bad are the answers to two questions: How did you earn it? What are you going to do with it?

Islamic law has developed very specific criteria to act as guides to assist us in following this middle course. In the first place, we are encouraged to engage in trade. Indeed, unlike religions that have a hostile view of those who work for monetary gain, our Prophet was a businessman, and his wife was a very successful businesswoman. In fact, he worked for her before they were married. She proposed marriage to him because she was so impressed with his success in marketing her goods in a caravan to Syria. Her servant reported that Muhammad had earned the unprecedented profit in an honorable manner. Muhammad accepted her proposal, objecting neither to the fact that she was fifteen years his senior, nor to her superior wealth.

Thus, businessmen and -women are not necessarily to be looked down upon. Rather, they are people to admire when they are honest, and when they, like Muhammed, use their acquired wealth in living the path of God or in doing good deeds.

In the Qur'an itself, there are rules for making and keeping sound contracts, denunciations of fraud and of theft, etc. And within Islamic law, basic regulations may be found for maintaining an effective trade economy. For this reason, Muslim society during the classical era was an extremely productive and successful society. World trade was synonymous with Muslim trade for hundreds of years. We also find in the example of the Prophet many beneficial practices. For example, money was always hard money. The early Muslims never engaged in debasing currency, nor did they use unbacked paper money, which has caused so many problems in modern times.

Muslim physicians in the classical era would look at the complaint from three points of view: the physical, the mental, and the spiritual. Currently in our society, there is an emerging movement to take such a holistic approach, a direction that the Islamic worldview would very much admire and encourage.

Usury (ribâ)

There is an issue that I do not want to devote much time to here, but which I certainly have to mention. Islam is opposed to *ribâ*, usually translated as usury, but which includes all over-charging. The overwhelming majority of Islamic scholars interpret any interest on loans to be a form of usury. I have argued elsewhere[5] that this interpretation is unsupportable, but that is a peripheral issue for us today. Let me simply note that the fundamental principle behind the prohibition of *ribâ* is the prohibition of any kind of malicious practices that would have an undermining effect on a healthy economy.

Let me give one example of something that in the *Hadîth* is called *ribâ*, but which is not interest and is not what is normally thought of as usury. An early companion of the Prophet named Bilal gave the Prophet some very high quality dates as a gift. The Prophet asked where he got the dates. Bilal said, "I had some inferior dates and exchanged two for one." The Prophet said, "Beware! Beware! This is definitely *ribâ*! Don't do so, but if you want to buy (a superior kind of dates) sell the inferior dates for money and then buy the superior kind of dates with that money."[6] Some have looked at this *hadîth* and concluded that barter of like for like is prohibited in Islam. I don't think that is exactly right. What it does say is that if you are going to exchange goods of different quality, you want to make absolutely sure that the exchange is at the market price. The best way to do that is to sell the one and buy the other. And so this means that he was encouraging a money-based economy, which is extremely helpful for any productive economic society.

Land

Islamic law pays a lot of attention to land, and there are a number of varieties and classifications of land, the use of land being very well studied and analyzed. Normally, the two kinds of land are developed land and undeveloped land. Developed land belongs to the person who has developed it. If it is abandoned land, it can be assigned in tracts to purchasers or users, or rented in exchange for a land tax called *kharâj*— or, in the case of Muslims, for that part of their *Zakât* called *ushr*. (*Zakât* is the charitable tithe incumbent on Muslims.) There is also wasteland or dead land, which becomes the property of whoever develops it. So someone can take

possession of wasteland by putting it to some good use. This is equivalent to the American concept of homesteading.

In addition, there is *harîm* land (from the root meaning "prohibited"), either public or private land, which is prohibited from development in order to preserve it. An example of private *harîm* land is the border around my home, which is also mine even though I do not develop it. I can leave it as a buffer zone, providing myself with a kind of "air space," in order to live in comfort. Similarly, the government can set aside tracts of public land to serve preservationist purposes. There are restrictions, though, to keep the government from going beyond what is needed for legitimate environmental purposes, and going overboard in order to keep people off the land and artificially increase the price of real estate and land taxes.

Technology

Technology has a spiritual dimension from the Muslim point of view. Perhaps the best example of practicing moderation in the use of technology is Islamic medicine. Medieval medicine in the West was very anti-technology in its approach. Here is an example, taken from the twelfth-century writer, Ibn Munqidh:

> Usamah Ibn Mundqidh, a twelfth-century Muslim world traveler from Syria, [reported] that in medieval Europe patients were often treated by priests without any knowledge of medical science. Even European "physicians" seemed more influenced by theologically-tinged superstition than by clinical research. Usamah learned the following story from an Arab Christian physician who had offered to treat a woman afflicted with imbecility. The physician prescribed a change of diet, but a European physician protested his methods. The European diagnosed the problem as a demon in the woman's head and ordered her hair be shaved off. She returned to her normal diet (of garlic and mustard), and her condition worsened.
>
> The physician then said, "The devil has penetrated her head." He therefore took a razor, made a deep cruciform incision on it, peeled off the skin at the middle of the incision until the bone of the skull was exposed and rubbed it with salt. The woman...expired instantly.[7]

Despite his low opinion of European medicine in general, it is significant that Usamah did adopt those popular remedies he found there which he judged to be safe and effective.

At the other extreme, modern medicine often displays a purely materialistic approach to people's health. A patient goes to the doctor with a complaint; then medical personnel run a battery of tests at the lab. When the results come back, the doctor can look up a prescription of drugs in a table.

Muslim physicians in the classical era would come and talk to a patient. They would look at the complaint from three points of view: the physical, the mental, and the spiritual. They were interested not only in tests to determine one's physical state; but they also wanted to know "What is happening in your life? Tell me about your spouse, tell me about your children, tell me about the stresses you are experiencing."

Currently in our society, there is an emerging movement for health professionals to take such a holistic approach, a direction that the Islamic worldview would very much admire and encourage. This movement considers that a person's body is itself capable of spontaneously producing medicines sufficient to meet its ills, when the person's spiritual attitude is positive. Health professionals have to look at the whole person, including the mental state and spiritual state, as well as the results of physical tests. There is nothing wrong with physical testing, and you will not find Muslims anywhere that are against it. What they will be against is thinking that that is sufficient, that a doctor has done all that is necessary by ordering these physical tests.

Environment

I now turn to the environment. Again, Islam takes a moderate view between the

extremes that I call propertarianism and Gaianism. Propertarianism is the view that, because private property is such a good thing and has so many benefits, therefore essentially everything should be looked at as private property, with no restrictions whatsoever on what one does with one's private property. Taken to its extreme in a *reductio ad absurdum*, this would be to say that since, under American law, I am allowed to own a gun and to own bullets, I have a right to shoot my bullets into anybody in this room. But even under American law this is a ridiculous conclusion. American law recognizes that my right to own and operate guns gives me no right to shoot them at other people or their property, except to defend myself and my own property. Why, then, shouldn't American law recognize that my right to own and operate a factory gives me *no* right to pollute other people's air or water with its emissions? The question is, where does the law draw the line?

At the other extreme is the modern idolatry that says that the world itself is a goddess, and we should worship this goddess and we should not do anything to infringe upon this goddess's health. It puts the earth itself above the interests of humankind. I often marvel that people can speak of "humans versus nature." They forget that humans are part of nature; we are part of the ecosystem. What we have to do is to be aware of our role as the *khalîfa*—not to act blindly, but to consider what the consequences of our actions are.

Let us take a look at four specific environmental concerns: the treatment of animals, forest preservation, pollution of water and land and air, and indirect effects on the environment, such as global warming.

Animal rights

Regarding animal rights, the propertarian point of view would be that animals are the private property of their owners, who have the right to do whatever they want with their private property. The Gaianist view—the other extreme—is that animals have the same rights as people. The Islamic view is in the middle: Animals do have rights, but they are not identical with human rights, because animals are not the *khalîfa*. However, there are things you cannot do to an animal even though the animal may be your property. For example, you cannot impose purposeless cruelties upon an animal. A propertarian would say, "Why not? I have a right. If I get pleasure out of torturing my dog, who are you to stop me?" Well, the answer is that dogs feel pain no less than people do. Therefore, dogs have the same right that people have to be free of frivolous and unwarranted pain. Humans have certain rights that dogs do not, by virtue of human intelligence; but the right to be free from cruelty has nothing to do with intelligence, but rather with the ability to feel pain. Therefore, yes, a person has no right to torture an animal.

We find in the *hadîth* of the Prophet that you have no right to overburden animals. If you have a camel and use it to haul your merchandise to Syria, this is permitted as long as you put on the camel what it can bear. Would you want God to put on you more than you can bear in this life? Of course you would not. You should treat the animals with the same dignity that you expect God to treat you. If you are above the animals because of your intelligence, God is far above you, beyond even that, in Intelligence. So be not unjust to the animals any more than you would want God to be unjust to you. Yet, you do have the right to use the camel to carry goods to Syria. Those who argue that using a camel for labor, or its hair for a sweater, or its meat for food, is somehow unjust exploitation, do not make sense.

From my Islamic perspective, I admire the attitude of American Indians toward other living things. They view all Creation as a family of brothers and sisters under the Great Spirit. They kill animals for food, but not wantonly. Before killing an animal, an Indian first apologizes to it, saying, "I am sorry, my brother, or my sister," and then proceeds with the kill.

Forest preservation

What about the issue of the trees, of the forest. I have to admit I am a tree lover. The Prophet (PBUH) put a great emphasis on trees, so much so that when he wanted to make a point about acts of charity and their importance, he used the planting of trees as an example. He said that when you die, your record book is closed on what you have done and you can accrue no more credits, with three exceptions. One exception was that if you had planted a tree that continues to give shade and fruit for the benefit of the people. Another was if you had written a book so that people can read the book and benefit from it. The third was if you had raised a pious child who would pray for you.

Animals do have rights, but they are not identical with human rights, because animals are not the* khalîfa. *Those who argue that using a camel for labor, or its hair for a sweater, or its meat for food, is somehow unjust exploitation, do not make sense.

These three examples really point to a single principle. You can get credit if whatever you have done in your lifetime continues to give benefit after you are gone. It doesn't have to be a tree or a book or a child; it can be anything that continues to give benefit. And so this was the motivation for the establishment of *awqâf*, or charitable endowments. Muslims would donate part of their wealth to what we would today call a charitable trust. They could do this before death or in their will as a bequest. They would write a charter for a trust and give a designation and a purpose of mission for the trust—the benefit it was intended to bring to the world. They set up hospitals, schools, parks, fountains, mosques, even canals. They would appoint trustees who would be in charge of the trust and a mechanism for the passing on of the trusteeship to future trustees as the need arose. This was actually how the infrastructure of the classical Muslim world was built up, because they didn't have nation-states in those days. Even when the ruler wanted to construct some public benefit, he would usually do it by setting up a *waqf* by that same mechanism. And this was a method by which you could indeed grow trees. You could make a forest preserve or a parkland. It was a mechanism for providing for those *harîm* purposes that the society needs.

Pollution

Turning to the topic of pollution, consider once again the question I asked earlier: Why is it that American law recognizes a natural limit on my right to spray bullets into the environment but no natural limit on my right to spray pollutants into the environment? Why does it require that pollution be dealt with by special legislation? The answer lies in an enormous legal error made in eighteenth-century England. The owner of an apple orchard sued the owner of a factory because the factory's smokestacks were producing so much pollution that it was destroying the farmer's apple trees. The court ruled against the farmer. The court argued that, in view of the fact that the jobs provided by the factory were so important and that the wealth that it was contributing to society was so important, the public good required the farmer's trees suffer. I think this was a major mistake within the boundaries of Western law; certainly under Islamic law such a decision would be utterly unacceptable. In the first place, of course, the damage to the farmer's property is seen to be subsidizing the factory, which is inexcusable. In the second place, the value of the trees themselves was lost, not only to the farmer but also to the society as a whole, as they were part of the wider environment.

Subtle environmental damage

Finally, consider the more subtle damages to the environment, for example, global warming. In my own mind I still haven't made a decision on this issue. I have not been persuaded by what I have seen in the data. However, that fact in itself raises an important question. At what point is the community justified in infringing upon the activities of the individual? I think that under Islamic law it has been made clear that the burden of proof is on the community. In Islamic law, everything is permitted except what is explicitly prohibited. If someone's rights and freedoms have been compromised by the actions of someone else, the burden is to show where the damage lies and to prove it conclusively. Thus the need for proper investigation.

Under Islamic law, a plaintiff must always meet the standards of proof, which can be very, very difficult, depending on the particular circumstance under consideration. Here is an example that involves a social issue rather than an environmental issue, but it makes the point rather clearly. In matters of sex crimes, the standard of proof in Islamic law is very high. A person cannot be convicted of adultery without the testimony of four eye-witnesses. Islamic law tries to balance the social welfare of the community against the right of privacy of the individual. It does this by making the punishments severe, but by making the rules of evidence very strict, as well. In this case, social welfare is being addressed, but not through some authoritarian type of command structure that sacrifices the privacy of the individuals in the society.

Internalizing the law

Well, how do we deal with these issues? We return to the issue of spirituality. The best way to deal with all of these issues is by an internalization of the law. You want people to take a moderate path. You want them to be productive, to increase their wealth and to use it for a good purpose, but not to be dazzled by the wealth so that they are willing to engage in forbidden or harmful activities. How do you do this? Well, you could have a set of laws and a network of spies who go out on society and follow people around and see what they are doing. This is not a good way for a number of reasons. Not only is it inefficient, but it is itself unspiritual. The ideal method is for people to adopt these laws internally so that they actually love the law, they approve of the law, they appreciate it, and they feel its importance within their souls.

How do you enforce a law, for instance, that prohibits the cruel treatment of animals? A Muslim tradition of unknown origin explains that if you must kill a pest, you should try to do it with the first blow. And if you swat a fly and only maim it on the first blow, you ought to feel a pang and say, "Oh, God, forgive me that I have made this fly to suffer."

For that reason, in Islam (as in Judaism) there is a certain ritual that is required in the killing of animals for food, to bring an awareness of the gravity of what is happening, and to ensure that it is done in the most humane manner possible.

Value of goods and just commerce

I would like now to talk about the difference between a view of scarcity and a view of abundance. In economics we talk about scarcity, because for any given good, there so many uses to which it could be put that there isn't of it enough to go around. But in Islam, we also think about abundance. For all the good with which God has blessed us, it diminishes God's wealth less than dipping a needle in the ocean diminishes the water in the ocean. God offers us abundance and yet there is scarcity. How do we reconcile these concepts? I think this was rather well explained by Warren Brookes, a Christian economist who wrote a book called *The Economy in Mind*. About a hundred years ago, the Austrian economist Carl Menger proved that the value of economic goods is subjective. It is in the mind. Until then, most economists, whether they were right-wing or left-

wing economists, thought that labor was the source of value. Menger showed that it is not. If you were to give me a canvas, some paint brushes and paint, I could work for two hours and I could produce something that not one of you would offer me a nickel for. But Picasso, in ten minutes, with the same materials, could produce a painting that some of you would mortgage your houses to buy. And when your child comes home from school with a painting in water colors, some of you would pay more for that than for the Picasso. What is the difference? The difference is in what you see in those paintings. It is in your mind.

At one time, I was so disgusted with all the get-rich quick schemes that you see advertised on the internet and in newspaper classifieds that I thought up my own idea for a get-rich-quick scheme. I would publish a little ad saying, "Send ten dollars and I will send you an explanation of how you can become rich instantly, guaranteed or your money back if you can prove that I am wrong." You would send me the ten dollars and I would send you just a single sheet of paper on which it says: "Let's first define our terms. What does it mean to be rich? I define rich to mean being able to afford to have anything you want. Most people would agree. Then, the secret to becoming rich instantly is to want only what you can afford." I think you all owe me ten dollars now!

There is an important point here: It is in our mind and in our understanding that value originates. That subjective value gets turned into economic value when we have a market. A market is a place where we all get together and we compare the different goods we have and how much they are worth to each of us, and we start to trade. All of a sudden, wonderful things happen. All of our wealth increases, because there are all of these voluntary exchanges where each exchange results in both parties increasing their wealth. But this will only happen if you have a set of rules that guarantees that these exchanges are truly voluntary. How can an exchange not be voluntary? Well, for example, if I take that gun I mentioned before and I point it at you and say, "You trade that coat of yours for this pen in my pocket or I'll shoot you." In this case, obviously, the exchange is going to result in a loss for you. That is not an allowed exchange; that is prohibited by the market rules. Fraud also results in a loss to one side and also would be a prohibited exchange. If I told you, "I'll trade this computer for your jacket," and you say, "Hey, that sounds like a good deal to me," but then you get it home and find that the computer doesn't work, you've been defrauded. Similarly I would say that an exchange that results in a degradation of the environment, a provable degradation of the environment, will also be a prohibited exchange. Suppose I offer you some money if you will cut down some trees in a certain location, and cutting down those trees results in the erosion of a neighboring farmer's field. Now it is true that I've gained and you've gained, but the farmer has lost, and he was never even consulted about it.

We have a principle here. I think that that principle is one that takes a central role in the Islamic law. Remember we are God's *khalîfa*. We are here to take care of, in a productive way, God's wonderful, abundant gifts that have been given us and to increase that abundance. God says, "Let there be amongst you traffic and trade by mutual good-will" [4:22]. And the Qur'an says to seek the bounties of God.[8]

Muslims don't have a sabbath. Some people refer to Friday as the sabbath in Islam, but we don't have a sabbath. Sabbath is the day you are not supposed to work. Friday is the day of congregational prayer. The Qur'an says:

> O ye who believe! when the call is proclaimed to prayer on Friday (the Day of Assembly) hasten earnestly to the Remembrance of God and leave off business (and traffic): that is best for you if ye but knew! And when the Prayer is finished then may ye disperse through the land and seek of the Bounty of Allah: and celebrate the Praises of God often (and without stint): that ye may prosper.
>
> (62:9)

Engaging in productive business is part of Islam. Doing good in this life is part of Islam. Christians, too, have the concept of a "calling." God gives us a calling and the calling may be to become a businessman. Whether we are scientists, engineers, artists, whatever it is, if we do it in a way that is positive for the benefit of everybody in society, then indeed we are fulfilling our role as the *khalîfa*. And the whole of Islamic law is a commentary on how one can best do that.

I say the words I have said; and I ask for God's forgiveness.

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1. Lane and Ahmad, pp. 210-241.
2. Lovelock.
3. Ahmad, *Signs in the Heavens*, pp. 70-71.
4. *Sahih Bukhari*, vol. 3, no. 632, p. 379.
5. Ahmad, "Riba and Interest."
6. *Sahih Bukhari*, vol. 3, no. 506, p. 291.
7. Ibn Munqidh.
8. E.g., 17:12.

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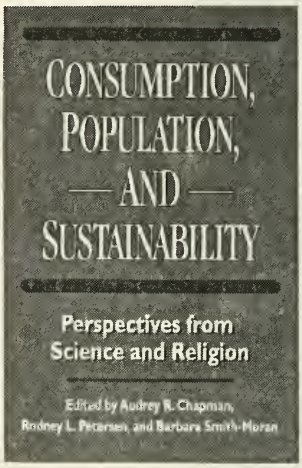
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The Potential of the Science-Religion Confluence for Affecting Policy and Administration

Bruce Babbitt
United States Department of the Interior

The author's understanding of the full scope of God's covenant after the Flood, together with the scientific insights of systems theory, guided him to implement a new approach in administering national restoration and protection policy. He is convinced that attempts by Congress to dismantle such legislation as the Endangered Species Act of 1973 are founded upon fear of the potential power of the conjunction of spiritual values with scientific insight.

I've been doing some reflection about what lies at the intersection between religion and science. And I've had to do it in the pressurized atmosphere of contention, of change, of radical proposals coming at us—really unprecedented kinds attacks upon the whole idea of community.

I am reminded, here in Boston, of Paul Revere, sounding a warning across the land. We have our own obligation to sound the alarm. When Paul Revere was riding, the agreed-upon lantern signal in Old North Church was "One if by land, two if by sea." And it occurred to me that, if he were here tonight, he'd look up at Old North Church and he'd be terrorized. He'd see *three* lanterns burning, because this attack is coming by land, by water—from every side. It's an attack upon the whole notion of public lands, of any kind of public interest in the landscape. It's an attempt to repeal the 1972 Clean Water Act, all of the wetlands provisions and things that were begun to enable us to regain some sense of stewardship over the rivers and lakes.

I want to concentrate now, for a few minutes, on the Endangered Species Act of 1973, because it has become the flash-point for contention. It is the one law that is stirring the most passionate attempts at appeal in the United States Congress. It's been really singled out in a very special way. I'd like to reflect on why that is, and on why I think that the Endangered Species Act becomes a metaphor, if you will, for the efforts we make to bridge science and religion, joining them together in a harmonious way.

I have always sensed that the Endangered Species Act was undergirded by a kind of implicit sense of values, of really powerful, generalized values. I recall an Eco-Exposition in Los Angeles, not long ago. Somebody from my Department put up a sheet of paper and invited a group of schoolchildren to write on that sheet of paper their answers to the question, "Why should we save endangered species?"

These were sixth, seventh, and eighth graders, giving their responses, and I've written down some of their answers. One youngster said, "Because God gave us the animals." Another child, named Travis, said, "Because we love them." A third one answered, "Because we'll be lonely without them." Another one said, "Because they're part of our life. If we did not have them, it would not be a complete world." Someone

else said, "The Lord put them on earth to be enjoyed, not destroyed." One answer really jumped out at me; down at the bottom of the page, someone had scrawled just three words: "Because we can." Now in thinking about that, I turned to reflect about the debate going on in the United States Congress, because Congress doesn't think that we can.

The new leadership in the Congress believes that the Endangered Species Act is exclusively a debate about utilitarian values. Nothing more. Admittedly, they define utilitarian fairly broadly: If a species is charismatic, let's save it. That takes care of lions and tigers. If some species are good for game hunting, let's save them—those species are invited "onto the Ark." For those who like to go fishing, they'll save the fish—but not *all* fish, mind you, because in the eyes of this Congress, most fish are "trash fish."

Congress has taken it upon themselves to redefine creation. They're willing to save the fish you go fly-fishing for, or bass fishing. Or if a plant species might conceivably be a potential source of medicines—like the Pacific yew tree or the Madagascar periwinkle—they'll concede that further discussion might be warranted for such species. But there is no other criterion that suggests that there is any other obligation. And therefore, they feel that their first task is to abolish the Endangered Species Act in its present form.

I've had occasion to think about this issue of values and this utilitarian approach, and I've thought back over my own childhood. I grew up in one of the most remarkable places in this land, a little town named Flagstaff, in northern Arizona. It is nestled at the foot of a great blue mountain that rises 6,000 feet above the town, straight up out of the desert. It's got a snow-capped summit that most of the time is obscured in the clouds. And as I was growing up, I always had a mystical attachment to that mountain. I knew it was a manifestation of something larger than physical reality. But in the church that I attended, the connection was never made.

I went to Sunday Mass from my earliest memories until I left that town in high school, and we never got outside the four walls of the church. There was never a connection made with the landscape. We were living in the most mystical, evocative landscape in the world, and the connection just wasn't there. In the religious tradition that I grew up in—in that particular generation and time and phase—our relationship to the natural world was without voice. The view of this relationship was a reflection of the prevailing utilitarian view of the natural world, with its long precedence in philosophy and theology.

I'd like to reflect on why I think that the Endangered Species Act becomes a metaphor, if you will, for the efforts we make to bridge science and religion, joining them together in a harmonious way.

I felt then that I had to go to another religious tradition to make the connection. Now the remarkable thing was that just such a religious tradition was on the other side of that same mountain. It was a Hopi Indian friend of mine who, one summer, led me by the hand out to the pueblos, sitting up on the enchanted mesas, extending off to the north.

It was a summer morning in June, the *kachina* dancers were filing into the plaza. And in the most literal way, he explained to me that these *kachinas* come from the summit of that sacred mountain, where they are the intermediary between the Divinity and

us. And as I watched this ritual unfold in the plaza, I felt the poverty in the midst of my own rich religious tradition. That connection with the landscape just wasn't there. Later in the summer, my friend took me back for the Snake Dances, and I saw another of the pageants in the Hopi sacred cycle unfold in the plaza. They prayed for rain and released the serpents to carry the message back into a landscape saturated with sacred meaning.

I began to wonder whether my only choice was to embrace someone else's culture, or whether I might turn back and have a second look at my own religious tradition. Like most of us, what I did was head back to my own religious tradition.

The Catholic priests who taught me were not big on having us rummaging around in the Bible independently. But being a brave, adventuresome soul, I went back and started exploring in Genesis, and I was immediately taken by the accounts of Creation and the Deluge. I'd always heard the rationalization that God gave dominion over the Earth to humankind.

But then I read carefully for the first time the account of the Deluge. And I read the familiar parts about Noah being commanded to take the species, clean and unclean, two by two, seven by seven, all of Creation into the Ark—*not* two charismatic species, *not* those waterfowl that we hunt, *not* the potential sources of medicine—but two by two, *all* of Creation. And in rereading it, what came through to me finally was the covenant at the end that runs between God and Noah and his children. But that covenant, sealed by the rainbow, also runs between God and the Earth. That's when I "closed the triangle" and began to understand that there *is* a connection—that this landscape and that great blue mountain *are* sacred, that it *isn't* some piece of property, that it *is* God's Creation.

Enlightened by this journey, I've had occasion to begin to think about the meaning of the Endangered Species Act, and the reason that it is so threatening to those people in their radical quest to erase the architecture of protection that we've built up over the decades, as a people. I began to see that the reason it's so threatening is precisely because it is so laden with spiritual value. I began to understand that the Endangered Species Act really is, intentionally or unintentionally, a reflection of the command of Genesis, of the covenant of Genesis. It speaks of the potential of spiritual values.

The children who were writing their messages on the board at the Eco-Exposition implicitly understand those spiritual values, even if the United States Congress doesn't. Our task, therefore, is to begin to appreciate that the reason why it is so threatening is that it represents an incredibly powerful conjunction of spiritual values and science.

In the religious tradition that I grew up in—in that particular generation and time and phase—our relationship to the natural world was without voice. The view of this relationship was a reflection of the prevailing utilitarian view of the natural world, with its long precedence in philosophy and theology.

Informed by that conjunction, I began to examine my conscience, if you will, about the administration of this Endangered Species Act. I began to see some really important things. I saw that my predecessors and a lot of really well-intentioned scientists and

administrators across the past twenty years have been administering the Endangered Species Act in a manner that is really devoid of this understanding of its spiritual values. They have tended to intervene one species at a time, not seeing the totality of creation. They have managed one crisis after another, at the eleventh hour precisely, because the scientists hadn't had the stimulus of the values statement behind the injunction to protect biodiversity.

And so, as we began to look at how we administer the Endangered Species Act, watching both the values and the science, we came to some surprising conclusions. The first really big one was in the Pacific Northwest, where the Spotted Owl had been the subject of contention for some ten years and had reached an absolute impasse. I began to see it in a different way I saw it wasn't about an owl; it's about the setting in which the owl lives. The Spotted Owl is a warning signal about a *system in crisis*.

And all of a sudden, with that insight, we were able to step back and see that we needed to erase the lines on the map and look at the Cascade Mountains from Puget Sound clear down to San Francisco Bay. We needed to look not at *one bird*, but at *hundreds of species*. We managed to get the scientists together and to strip off their jurisdictional badges and look at the *entire system*, infused and hopefully inflamed by the value judgment that it is our job to protect biodiversity, God's Creation.

Out of that came an unprecedented study, based on the viability of the different species, based on forestry practice, and so forth—just looking at the whole thing as a system and reassembling it as a system, from the Spotted Owl, to the Marbled Murrelet, to the fish spawning in the stream. As an act of faith, we believed that in the end there would be room for humankind—that if this way of approaching the landscape is a reflection of a larger purpose, then we are a part of that purpose.

And that's what this "new look" is about. It isn't about creating more wilderness areas, exclusively. We used to do that. That was an interesting view of Creation, but it wasn't perfect, because it didn't deal with *humanity's* place in Creation. We can't deal with Creation by "fencing off the back forty." We can't do that, because everything relates. Ultimately, we're driven to look at the whole thing, to see it whole, and then to ask what the moral injunctions are upon *us* as a species, to live a little more lightly upon that landscape and to see it whole.

I saw that my predecessors and a lot of really well-intentioned scientists and administrators across the past twenty years have been administering the Endangered Species Act in a manner devoid of this understanding of its spiritual values. They have tended to intervene one species at a time, not seeing the totality of creation.

The second conclusion we've reached, in watching both the values and the science in our administration of the Endangered Species Act, is how to approach the Florida Everglades. Here was a National Park with a fence around it, and it was collapsing, desiccated, dead. The reason is that Creation isn't very susceptible of being partitioned into little squares while we say, "Well, here's a representative sample of God's Creation, and we're going to set it aside as we lay waste to the rest of it."

The problem wasn't in Everglades National Park; the Park Rangers had taken great care of it. The problem was two hundred miles away to the north, in Lake Okeechobee. The problem was the water supply: that artery of water had been severed by the Corps of Engineers, to drain the swamps to create a vast developed area of agriculture; and in the process, the *system* was collapsing. So we were driven, once again, to consider what the value issues are here. This forced us to bring in the State of Florida, the developers, agriculture, the Water Management District, sixteen different federal agencies, and others. This issue, ultimately, is about how we live on the landscape.

The ecosystem called Florida is all connected. Ultimately, our job of restoration and protection entered every facet of life in the whole community, and we had to find some way to stitch that hydrological system back together. We are on the road to getting that done, notwithstanding what's going on in Washington. People in Florida seem to have an intuitive appreciation for the rightness of this way of doing it.

I've got to say again and again that their sense of the rightness is a combination of my ability to persuade them that biodiversity is a valid scientific concept and, more importantly, of their own internal spiritual values. They understand and believe the injunction of Genesis. They understand that there is something beyond a utilitarian issue here. It isn't exclusively about short tons of sugar cane and tons of fish catch in Florida Bay. It's about a larger issue called "humility in front of God's Creation." How powerful an idea that it! It's not just an idea—it's a reality! And when that comes together with the scientific concepts, the possibilities are enormous.

This is the big realization that has confronted me, in terms of policy. I'm increasingly certain that the reason this law is such a flash-point is precisely because the people who are out to destroy all that we've created understand that this is "The Big One," because it is so laden with spiritual values. It drives them absolutely crazy.

I'll give just one example of that. A couple of weeks ago, a number of your Churches wrote letters to the Congress, making this point, in your respective ways, about values. Those letters were offered into the record of the House Natural Resources Committee. This is routinely done. They're always accepted. The Chairman of the Committee refused your letters. He would not allow them into the record.

There is something beyond a utilitarian issue here. It isn't exclusively about short tons of sugar cane and tons of fish catch in Florida Bay. It's about a larger issue called "humility in front of God's Creation." And when that comes together with the scientific concepts, the possibilities are enormous.

That, to me, is a statement that the new leaders of Congress understand the power of the confluence of these two streams of science and religion, and of our place and our role—not regarding *our property*, but regarding *God's Creation*. And so I urge you to continue to find the places where the tributaries of science and religion flow together and create a mainstream. Ultimately, the political process is dominated by and determined by values.

Bruce Babbitt was the Governor of Arizona from 1977 till 1987. After practicing law for a number of years in the Washington, D.C., area, in 1993 he was appointed by President Bill Clinton to be the Secretary of the Department of the Interior, a position he holds today.

After graduating from the University of Notre Dame with a B.A. in geology, he earned an M.S. degree in geophysics from the University of Newcastle, England. He then turned to the study of law, earning an L.L.B. degree from Harvard Law School.

Secretary Babbitt's tenure as Secretary of the Interior is marked by important initiatives in administrative policy: large-scale, consensus-based environmental restoration projects with an awareness of ecosystem dynamics. He describes the evolution of this approach in his essay here, which he gave as the keynote address at a conference in November 1995. Entitled "Consumption, Population & the Environment: Religion & Science Envision Equity for an Altered Creation," the conference was presented by the Boston Theological Institute together with the American Association for the Advancement of Science.

In the Beginning: American Physics, the Kansas Science Education Standards, and the Attack on Scientific Cosmology

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While the battle over teaching evolution in American public schools significantly predates the infamous 1925 Scopes, or "Monkey," Trial, the battle over teaching physics has just begun. In August,1999, the Kansas Board of Education voted to drop not only the theory of evolution from state science standards, but to remove the Big Bang theory of cosmic origins as well. It is important to view the Board's actions in the context of contemporary American culture, and its changing attitude toward physics. For much of the twentieth century, theoretical and experimental physics was viewed as good for American progress and essential to American defense. Now, however, the field is seen by an increasing number of Americans to be both irrelevant and a drain on the country's financial resources. Recognizing this shift is essential to understanding the new vulnerability of physics to proponents of creationism. Understanding why the shift is occurring is essential to any defense.

> My life has been so short that I really know nothing whatever. I was only made the day before yesterday. Whatever happened in the world before that time is all unknown to me.
>
> —the Scarecrow (who doesn't have a brain), speaking to Dorothy (a child from Kansas)
>
> —*The Wizard of Oz*, by Frank Baum

When the Kansas Board of Education voted to drop the theory of evolution from state science standards in August 1999, the move made headlines around the world. While dramatic, it was just the latest yank in a tug of war between creationists and evolutionists for control of American public school policy, a war that has continued for more than three quarters of a century.

Largely overlooked in the most recent controversy, but potentially of greater significance, was another deletion the board made. By a slim majority, the Board voted to remove passages from the original standards that dealt with the Big Bang theory of cosmic origins taught in physics classes. Instead of demonstrating competency in understanding the formation of the universe, the new standards merely asked that students achieve an understanding of the structure of the universe (for example, an understanding that "galaxies are found in clusters").[1] The standards do not prohibit teachers from teaching scientific cosmology; but since it will no longer be included on statewide student assessments, the apparent hope of the conservative majority is that teachers will not have time in the school year to address it.

The original draft of the science revisions submitted to the Board was written by a 27-member committee that included several members of the Kansas Academy of Science, an organization of scientists and science educators. However, a loosely-knit group of Kansas creationists pulled together by Celtie Johnson presented its own set of standards to the board. (Johnson is founder of the National Committee for Excellence

in Science Education, an organization to help citizens challenge the teaching of evolution.) They were assisted in this task by Glenn Kailer, a researcher with the Creation Science Association for Mid-America.[2] Their document was met with a sympathetic response by the the conservative majority on the board, who then proceeded to incorporate the creationist work into the advisory committee's draft.[3]

While the battle over teaching evolution in American public schools significantly pre-dates the infamous Scopes, or "Monkey," trial held in Tennessee in 1925, the battle over teaching physics has just begun. Although a few preliminary shots have been fired over the bow in the last decade, the Kansas School Board's action is the first significant attack in eighteen years to be mounted at a statewide level.[4] And while the Board was subsequently forced to make a partial retreat, they have by no means surrendered. On 7 December 1999, Board members voted to replace the August revised guidelines with yet another revision and to have that version vetted by an outside reviewer. The changes became necessary when three national science organizations, citing the Board's anti-evolutionary stance, objected to the state's incorporation of copyrighted materials into the standards. Saying that the Kansas standards did not "embrace the vision and content" of their groups' national documents, the National Research Council, the American Association for the Advancement of Science, and the National Science Teachers Association revoked their permission to use the copyrighted materials.[5]

But the Board, if bloodied, is unbowed. According the latest revision,

> Some scientific concepts and themes (eg. blood transfusion, human sexuality, nervous system role in human consciousness, cosmological and biological evolution, etc.) may conflict with a student's religious or cultural beliefs. The goal is to enhance understanding, and a science teacher has a responsibility to enhance students' understanding of scientific concepts and themes. Compelling student belief is inconsistent with the goal of education. Nothing in science or any other field of knowledge should be taught dogmatically.[6]

It is important to put the Kansas School Board's actions in the context of contemporary American culture and the changing way it is regarding the practice of physics. While for much of this century both theoretical and experimental physics have been viewed as somehow sacrosanct, there are indications that that perception is shifting significantly. Once seen as good for American progress and essential to American defense, physics is increasingly seen as an irrelevant drain on the country's financial resources.

Recognizing this perceptual shift is essential to understanding physics' new vulnerability to creationism. Understanding why the shift is occurring is essential to any proposed defense.

Physics: before the Fall

At the same time William Jennings Bryan and Clarence Darrow were squaring off in a Tennessee courtroom, American physics was entering a golden period that would last for the next half century. "We are evidently in an era of still more remarkable discoveries concerning the nature and laws of the physical world," claimed Princeton University President John Grier Hibben in his 1925 "Report of the President," and few would have disagreed with him.[7] Most of the action was taking place in Europe, where physicists divided themselves roughly into two camps: those who took the radical approach to quantum mechanics pioneered by Neils Bohr and Max Born, and those who followed the more conservative path cut by Albert Einstein. But American physicists, determined to get into the game, made the acquisition of theorists an important part of their expansion programs. "No field of physics at the present time is of greater importance," wrote Karl T. Compton, chairman of the Princeton

physics department, in that same year. "In this country we have carried [our] experimental sides to a high degree of achievement, but...theoretical developments...are coming largely from Germany."[8] The public had already been primed to identify with and support the work of science, particularly physics. In 1920, publishing magnate Edward W. Scripps launched the popular Science Service, a news service with a board of trustees representing both journalists and science organizations.[9] Publishers brought out numerous science books for the general public; and magazines lauded the efforts of scientists not only to make technological advancements, but to solve the mysteries of the universe. Improbable by today's journalistic practices, in 1923, *The New York Times* won a Pulitzer Prize for its coverage of the Annual Meeting of the American Association for the Advancement of Science.

The public was already aware of the value of science to national security. During World War I, the National Academy of Science, at President Wilson's request, formed the National Research Council. The NRC's mission was to encourage both pure and applied research with the ultimate goal of furthering "the national security and welfare." "True Preparedness," the Academy stressed, meant pure as well as applied research.[10] Pure physics became applied physics in the pursuit of German U-boats.

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Physics, as did everything else, suffered from economic constraints during the Depression, but the rebound was swift. By 1936, *Newsweek* would proclaim, "The United States leads the world in physics."[11] Prominent graduate schools were offering first-rate training and facilities, and America had more cyclotrons than the rest of the world combined. The United States became a magnet for physicists seeking refuge from political instability in Europe; their contributions to American physics should not be minimized. However, their impact would not have been so significant if there had not, as J. Robert Oppenheimer observed, already been "a rather sturdy indigenous effort in physics" and the infrastructure to support it.[12]

In 1938, almost 1300 American scholars and scientists, conscious of the growing threat to academic freedom in Germany, issued a manifesto condemning the fascist suppression of science and the Nazi racial policies.[13] Affirming the legitimacy of modern theoretical physics, they concluded, "Any attack upon freedom of thought in one sphere, even as non-political a sphere as theoretical physics, is an attack on democracy itself."[14]

The relationship of American physicists to the war effort was a complex one. By and large, the physics community moved away from isolationism at a quicker pace than did the general public. The development of Albert Einstein's position is in no way atypical. Before 1933, Einstein, a socialist and pacifist, repeatedly called for resistance to military service and for scientists to refuse to lend their science to the military. By 1933, he had publicly declared he saw no alternative to the rearmament of western democracies.[15] Six years later he had, together with Leo Szilard, written his famous letter to President Roosevelt advis-

ing that "extremely powerful bombs of a new type" could be made of fissionable materials, and urging that the president "speed up the experimental work" being done.[16] (Einstein's own work on the war effort was hampered by the fact that the German physicist was regarded as a security risk. He rode out the war years working—officially, at least —on an unified theory of relativity.)[17]

But while the atomic bomb was the most visible (and to the public mind, at least, most important) contribution of physics to the war effort, the development of three other projects—solid-fuel rockets, the proximity fuse (which could explode an artillery shell at a set distance from its target), and, most critically, microwave radar—were essential to the success of the Allied effort.[18]

Post-war physicists lobbied aggressively and somewhat successfully to have control of the nation's science returned to civilian hands. In 1946, Congress created the civilian Atomic Energy Commission, which had broad powers over the production, use, and ownership of fissionable material, as well as the authority to dispense information and funding for pure and applied science. However, in that same year, Congress made the Office of Naval Research a permanent agency; and the funding and direction of American science came increasingly under the direction of the military.

The launch of the Soviet satellite Sputnik I on 4 October 1957 galvanized America. On 7 November, four days after the launch of Sputnik II, (this one with a rider on a one-way ticket: a dog, Laika) President Eisenhower announced the creation of the post of Special Assistant to the President for Science and Technology. Between 1957 and 1961, federal expenditures for research and development more than doubled, and increased funding for student support and facilities was provided under the National Defense Education Act. And in May 1959, Eisenhower announced he would ask Congress to fund Stanford's giant linear accelerator—a proposal that had been received tepidly in pre-Sputnik 1957.[19] Between 1957 and 1967, the number of institutions offering doctorates in physics nearly doubled, with physics Ph.D.s going disproportionately into academia.[20] In his book, *The Physicists: The History of a Scientific Community in Modern America*, Daniel J. Kevles recalls,

> It was a time when Americans ranked nuclear physicists third in occupational status—they had been fifteenth in 1947—ahead of everyone except Supreme Court Justices and physicians; where physicists, among other scientists, were identified not only as the makers of bombs and rockets but as the progenitors of jet planes, computers and direct dial telephoning, of transistor radios, stereophonic phonographs, and color television; when research and development in...this 'age of the knowledge industry' were believed to generate endless economic expansion.... [21]

It was not to last. The growing American disenchantment with the Vietnam War meant that by the late sixties, many people no longer made the distinction between pure science and science that informed and supported the military-industrial complex. Protests escalated, despite the very vocal participation of many of the nation's leading physicists in the anti-war movement.

Improbable by today's journalistic practices, in 1923,* The New York Times *won a Pulitzer Prize for its coverage of the Annual Meeting of the American Association for the Advancement of Science.

In 1971, a thirty-three-year-old post-doctoral student was killed at the University of Wisconsin when an anti-war protestor's bomb blew up in a building shared by the Army Mathematical Research Center and the physics department. A year later, two more bombs ripped through a section of the Stanford Linear Accelerator. Mirroring the economic recession—which, for those physicists with long careers and memories, was reminiscent of that of the 1930s—science in the 1970s underwent a period of retrenchment. The number of physics Ph.D.s awarded declined steadily through the early and mid 1970s.[22] But the Fermi National Accelerator Laboratory (Fermilab), at Batavia, Illinois, was completed on time and within budget. And in November 1974, two teams of physicists working independently at Brookhaven and at Stanford detected a new particle, the "charmed" quark, bound to an anti-quark. Despite the fact that in 1976 *The New York Times* declared that physics was no longer the "glamor king" of the sciences,[23] it held enough allure that presidential candidate Jimmy Carter would conflate his service aboard a nuclear submarine and lay claim to being a "nuclear physicist."[24]

Throughout this entire period, there was one overarching figure, one enduring cultural icon. The name Einstein became American shorthand for genius, imposing intellect, unfathomable brilliance. Einstein was the point of entry through which the general public connected with pure science. They might not be able to talk about, much less understand, theoretical physics, but they could talk about Einstein. Einstein was time travel, splitting atoms, the secrets of the universe. Twenty years after his death, his cultural persona was as strong—if not stronger—than it had been during his lifetime.[25] Forty years after his death, physicists could still invoke his name to excite the popular imagination. But it was becoming harder to transfer that enthusiasm to their contemporary projects.

Cracks in the firmament: the death of the Supercollider

The 1970s had seen the development of the "standard model," which seeks to account for three of the four forces known in nature: the electromagnetic force, the weak force, and the strong force. (The fourth force, gravity, is not incorporated in the model.) Using the standard model, theoretical physicists hypothesize about the cosmological processes in effect as the universe is born. High energy accelerators can approximate some of the energies present in those early moments, giving experimental evidence of theoretical speculation.

At a meeting of high energy physicists in 1992, Nobel laureate and Fermilab director Leon Lederman urged that America reassert its dominance in HEP by building a supercollider. However, he would not prove quite quick enough. In 1983, physicists at the European Center for Nuclear Research (CERN) discovered the W- and Z-particles, two of the last firm predictions by the standard model. The next year, two European physicists, Simone van der Meer and Carlo Rubbia, were awarded the Nobel prize for the discovery, effectively bringing to an end to thirty years of domination by American high-energy physics.

In response to the Europeans' discovery, a blue-ribbon panel of American physicists recommended building a superconducting supercollider (SSC), which they claimed would become the "forefront high-energy facility of the world," essential for "a strong and creative United States high-energy physics program into the next century."[26] The High Energy Physics Advisory Panel to the Department of Energy issued its formal recommendation for the SSC in July 1983, and Congress began funding the project in 1985. The planned collider was to encircle an area 160 times greater than Fermilab and was to have an acceleration energy 60 times greater than the European CERN collider and 20 times greater than that of Fermilab. Its capacity was such

that, theoretically at least, it could reveal the presence of the Higgs boson.

In 1987, the Department of Energy sent out a request for site proposals. Twenty-five states responded. Physicists recommended Texas and Illinois, with preference going to Illinois and Fermilab. On 10 November 1988—the day after one-time Texas congressman George Bush was elected president—Waxahachie, Texas, was announced as the site of the new SSC.

Although few foresaw it, the selection of Waxahachie was the beginning of the end for the SSC. To begin with, while project supporters had succeeded in generating great enthusiasm for the potential benefits the SSC would bring to the selected community (jobs, jobs, and more jobs), they had done little to sell the entire country on the potential scientific benefits the SSC could bring. The instant the site was selected, the potential Senate constituency shrank from 100 to two. Congressional support waxed and waned, depending upon which pork-barrel projects were appended to SSC appropriations. And the Texas political muscle, which had brought the project South in the first place, unexpectedly dwindled. By 1992, with a permanent funding commitment to the SSC still not in place, George Bush was gone, replaced by Bill Clinton, whose support for the project consistently wavered.

The launch of the Soviet satellite Sputnik I on 4 October 1957 galvanized America. Between 1957 and 1961, federal expenditures for research and development more than doubled, and increased funding for student support and facilities was provided under the National Defense Education Act.

"Obviously, the Texas political clout which looked so formidable and gave us such reason for optimism disappeared," reflected Steven Weinberg, a Nobel laureate in physics and professor at the University of Texas.

> Jim Wright, [D-Texas] a very powerful speaker of the house, resigned. Lloyd Benson [*sic*; Lloyd Bentsen, D-Texas, and former vice-presidential nominee] left the chairmanship of the Senate Finance Committee and went to be Secretary of the Treasury, which doesn't put him in the position of influencing senators.[27]

Still, it appears the physicists could have done significantly more to capture the attention of the American public and the commitment of the Congress. In the land where Lucas and Spielberg are kings, it does seem that a search for the beginnings of the universe, properly marketed, could have found a constituency.[28] And certainly, with very little effort at all—"The Einstein collider," perhaps—the ultimate stamp of approval could have been placed on the project.

Even those non-physicists closest to the project had trouble conveying what was important about the collider. A little more than a month after the project was shut down, Waxahachie City Manager Bob Sokall mused,

> With the Space program at least you had something you could see, like men going to and from the moon. But with the supercollider what have you got to show? Things you can't even see going around and around in circles.[29]

But the inability of the theoretical physics establishment to convince the general public of the project's importance was not the only way physics demonstrated its new vulnerability. Deep divisions within the physics establishment itself were suddenly exposed to outsiders. Condensed-matter physi-

cists, tired of having their work considered second-class, were only too happy to challenge their brethren's claim on billions of federal dollars to fund the SSC. "Dollar for dollar," Philip Anderson, a Nobel-prize winner for his work in condensed matter physics, told a congressional subcommittee hearing on the SSC, "we in condensed-matter physics have spun off a lot more billions than the particle physicists...and we can honestly promise to continue to do so."[30]

Projects have lost public favor, and been beset by internecine squabbling, while still managing to receive ample federal funding. The most dramatic thing about the defeat of the supercollider was the precipitous erosion of congressional support, not merely for the collider, but also for the practice of physics. No longer was physics research automatically assumed to be of potential benefit to the national defense. The Cold War was over, and very few representatives could get excited about racing European scientists to the top quark. In the minds of Congressmen and -women, physics had been irrevocably divorced from national security.

The name Einstein became American shorthand for genius, imposing intellect, unfathomable brilliance. Forty years after his death, physicists could still invoke his name to excite the popular imagination. But it was becoming harder to transfer that enthusiasm to their contemporary projects.

Each time the SSC project came up for new appropriations, it was challenged both by moderate to liberal Democrats and moderate Republicans. Liberal Democrats argued that the money—projected costs had risen exponentially, from 4 billion to 8 to over 11 billion dollars—could better be spent on social welfare programs such as Headstart, HUD housing and support programs for Gulf War veterans.[31] Republicans raised questions about managerial competence, design problems, and the failure of the administration to secure promised foreign investment. In 1992, the House voted to kill the project, but an eleventh-hour rally by the Senate saved it.

By 1993, the Supercollider had gone through three administrations without a commitment to permanent funding. And in October of that year, the House pulled the plug on the project. Defying the advice of the President as well as the House leadership of both parties, 81 of the 113 freshman representatives casting votes moved to cut off all future funding for the SSC, even though more than 2 billion dollars had already been spent on the project. "It is obviously very energetic budget cutting," explained George E. Brown, Jr. (D-Calif.), Chair of the House Space, Science and Technology Committee.

> You have a majority who weren't even around when this project was started. It is a high priority target for them. A project that takes this long may no longer be viable in a Congress that has no collective memory.[32]

Or in the mind of an American public which no longer remembers the primacy of American physics.

The evolution of creationism: expanding to include physics

At the Fourth International Conference on Creationism, held in Pittsburgh in 1998, creationist astronomer Danny R. Faulkner, of the University of South Carolina at Lancaster, told the audience,

> While many Christians have entered the fields of biology and geology to combat evolution, the takeover of astronomy by

> evolutionary thinking has scarcely been noticed, and there are few qualified creationist astronomers. Unlike those other disciplines, there is no overall theory or, if you will, paradigm, of astronomy from a creationist perspective.

Part of the problem, he maintained, was a lack of researchers in the field.

> Most people see the obvious effect that evolution and long time scales have had on geology and biology, and this has attracted Christian young people to pursue these sciences. The result has been that while evolutionary thinking has come to dominate much of astronomy, this has escaped the notice of most creationists.[33]

Within the last decade, creation physicists have begun to publish books on creation cosmology in attempt to create familiarity with the subject; some, such as *Starlight and Time: Solving the Puzzle of Distant Starlight in a Young Universe*, written by D. Russell Humphreys—a leading creation scholar and a physicist with Sandia National Laboratories—have gone into multiple printings.[34] But until quite recently, most creationists have considered scientific cosmology incidental to the larger question of evolution. Creationists have usually followed three basic responses to scientific cosmology: criticism of the Big Bang, advancing the argument for design, and supporting evidence for a recent creation. But many creation scholars now are urging that the issue be considered independently of evolution, and that a more sophisticated challenge be mounted accordingly.

There is no single creationist position on the age of the earth and the age of the universe, although most creationists fall into one of three categories. First, there are those who believe that both the earth and the universe were created during a literal six-day creation week just a few thousand years ago. That position is held by the Institute for Creation Research (ICR)[35] and most members of the Creation Research Society (CRS). However, a second position—which holds that while the earth is only a few thousand years old, most of the universe was created in the distant past of Genesis' "In the beginning"—is also compatible with CRS theology.[36] Finally, there is the "liberal" wing of creationism, which attempts to reconcile modern science and biblical literalism by claiming the six days of Genesis refer to epochs of undetermined terrestrial length. "Often young-universe and old-universe creationists focus more energy on defending their respective positions then on reaching out to nonbelievers," writes Hugh Ross, an evangelical Christian and former radio astronomer, in his book, *Creation and Time: A Biblical and Scientific Perspective on the Creation-Date Controversy*.[37] Ross, who is the president of Reasons to Believe, a nonprofit organization dedicated to disseminating information about how science can be reconciled with the Bible, is a proponent of the "six long periods" approach to Genesis.

It is essential, Ross believes, that a creationist apologetics be developed. In *The Creator and the Cosmos*, he writes,

> Cosmological chauvinism is not simply a manifestation of academic pride. It reflects decades of increasing specialization in education. Universities long ago dropped theology from their science curriculum. Few, if any, seminaries draw students with a background in science...[While] theology and philosophy students may study the history of their organization, science students rarely do.[38]

It is useful at this point to consider the origins of the creationist movement. The term "scientific creationism" first entered the popular lexicon in the mid-sixties, following the 1961 publication of a book called *The Genesis Flood*, by John C. Whitcomb and Henry M Morris. In the following decade, several organizations were founded to promote the idea that the teachings of Genesis were supported by science. They include the aforementioned Institute for Creation Research, first established in California in 1970 as an arm of the fledgling Chris-

tian Heritage College, and dedicated to "research, publication, and teaching in those fields of science particularly relevant to the study of origins."[39] The ICR split from Christian Heritage College in 1981, establishing its own graduate-degree-granting program. The ICR is also arguably the world's largest disseminator of creationist pamphlets and tracts.

The ICR's primary competitor, the CRS, was formed in 1963 following a split from the American Scientific Affiliation. In turn, the Creation Science Research Center of San Diego (CSRC), which has a special outreach to children, was formed after a 1970 split from the CRS.[40]

A comparative newcomer to American creationism, but one who wields considerable influence, is Ken Ham, a Australian-born science teacher who first came to this country to work with the ICR. In late 1993 (with encouragement from the ICR, Ham maintains) he founded Answers in Genesis in a Kentucky storefront. Six years later, Answers in Genesis has its own offices, employs 50 people and claims an annual budget of 4.5 million dollars. About two-thirds of that comes from donations, Ham says, and the rest from the sale of books and videotapes.[41]

Kentucky has proved to be fertile ground for creationist cosmologists. In 1996, Marshall County School Superintendent Kenneth Shadowen ordered two pages in a fifth- and sixth-grade science textbook glued together. The pages discussed the Big Bang with no mention of the biblical account of creation. Shadowen defended his actions, saying, "We're not going to teach one theory and not teach another theory.... It has nothing to do with censorship or anything like that."[42] An apparently unconcerned state official told reporters, "It's unusual. But we are not going to send curriculum police down there to unglue the pages."[43]

Outreach efforts by organizations such as AiG are meeting with enviable success. Last spring, 600 people turned out to hear Ham speak at a Lexington, Kentucky, church. One, a 51-year-old postal inspector, said the seminar helped to reinforce his views about the creation of the earth. "One thing they do is they help your critical-thinking skills, in understanding what you believe and why you believe it, having a basis for that belief."[44]

Kansas creationism: a search for the origins

On the face of it, Kansas would seem an unlikely battleground for creationism. The state has a historical reputation for moderation, as evidenced by the politicians it has placed on the national stage: respected middle of the roaders such as former GOP Senators Bob Dole and Nancy Landon Kassebaum. But much lies below the surface.

The most dramatic thing about the defeat of the supercollider was the precipitous erosion of congressional support, not merely for the collider, but also for the practice of physics.

The roots of the School Board controversy can be found in the 1988 presidential campaign of evangelist Pat Robertson, according to Burdett A. Loomis, a political scientist at the University of Kansas. According to Loomis, Robertson energized a long-latent populist streak in Kansas.[45] The conservative social agenda gained increased attention, as Wichita-based Operation Rescue became the country's most visible anti-abortion group. National television crews followed the Rev. Fred Phelps around as he picketed the fu-

nerals of gay men. A Baptist minister from Topeka, Phelps is an extremist with an anti-homosexual agenda.

Religious conservatives began organizing at the grassroots level, and by 1996 they controlled the Kansas House of Representatives and much of the apparatus of the state GOP. (For a time, the state party was directed by a former head of the Kansas Christian Coalition.) That same year, national political observers turned their sights away from the presidential race to spotlight a battle for the 4th District seat on the Kansas Board of Education. It was paradigmatic, some analysts thought, of what was happening just below the surface of the Republican party across America.[46]

It seems probable that more and more of these battles will be fought, not in the legal courts, but in court of public opinion. As physicists struggle with their profession's diminished stature, they are particularly vulnerable to creationist advances.

The ostensible issue was "phonics." GOP insurgent candidate Rene Armbuster was making the teaching of phonics to young children the centerpiece of her campaign. But somehow other words kept getting thrown in there, words like "condom" and "permissiveness" and "Bible." And Armbuster just happened to be one of five school board candidates endorsed by the Kansas Education Watch Network (KEWNET), an organization that attacked sex and AIDS education, as well as the accreditation standards. "Having a majority of people on the Board who think like this," retiring Republican State Representative James E. Lowther warned prophetically, "would be a detriment to the children of Kansas."[47]

After the Bang: the implications for scientific cosmology

In 1981, the Arkansas legislature passed the "Balanced Treatment for Creation-Science and Evolution-Science Act" (Act 590), mandating the teaching of "creation-science" on a par with "evolution-science." The act held creation-science to be an "alternative scientific model of origins" that could be "presented from a strictly scientific standpoint."[48] The act was intended primarily to address issues related to human evolution; however, it did define creation-science as including "the scientific evidences and related inferences that indicate...[s]udden creation of the universe, energy, and life from nothing...."[49]

Suit was immediately brought in federal district court under the auspices of the American Civil Liberties Union, which contended that the act constituted an establishment of religion prohibited by the First Amendment, as well as an abridgment of academic freedom as guaranteed by the Free Speech clause, and a violation of the Due Process clause of the 14th Amendment. On 5 January 1982, the judge concurred and permanently enjoined the defendants from enacting Act 590.[50] The judge found that the act was "self-contradictory" and that a Genesis-based explanation for creation could not be taught without resorting to making religious claims. Interestingly, the judge also challenged the creationists' methodology, writing:

> A scientific theory must be tentative and always subject to revision or abandonment in light of facts that are inconsistent with, or falsify, the theory. A theory that is by its own terms dogmatic, absolutist and never subject to revision is not a scientific theory.[51]

It seems highly likely that the Kansas creationists had this ruling in mind when they offered their draft version of the science standards to the Board of Education. By omit-

ting the teaching of certain subjects (e.g., the Big Bang, evolution) rather than requiring that certain subjects be taught (e.g., creation-science) the standards could be effectively insulated from legal challenge. The net effect would be almost the same—however: evolution and scientific cosmology, instead of being placed on equal footing with creationism, would be diminished by omission.

It seems probable that more and more of these battles will be fought, not in the legal courts, but in court of public opinion. As physicists struggle with their profession's diminished stature, they are particularly vulnerable to creationist advances. Some physicists have already recognized that vulnerability and taken action. In New Mexico, physicist Marshall Berman started an organization to combat creationist influence; in 1998 he defeated a 20-year state School Board incumbent who supported creationists' attempts to influence science content in the state's public schools. On 8 October 1999, the New Mexico Board of Education voted 10-1 to adopt new educational guidelines affirming, among other things, the theory of evolution and scientific cosmology.[52] After the vote, Berman released a statement reflecting on the victory.

> But this is not a time to relax. Creationists have scored heavily around the country. Perhaps it is only natural for attacks on science to wax and wane over the decades. But we cannot afford to lose any more battles. The struggle between ignorance and knowledge is eternal.[53]

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1. Kansas, 7 Dec. 1999 revision.

2. Beem, "Woman's Creationism Shakes Up Public Education."

3. Learning.

4. The Arkansas creation-science act of 1981 will be discussed in greater detail below. While the act, which later fell to a court challenge, mandated the teaching of creationist cosmology on a par with scientific cosmology, cosmology was treated only as a starting point for creation or evolutionary theory.

5. Beem, "Science Standards Rewritten."

6. Kansas, op. cit.

7. Kevles, p. 157.

8. Compton to Henry Allen Moe, cited in Kevles, footnote 1, p.169.

9. Ibid., p. 171.

10. Ibid., pp. 112-113.

11. Ibid., p. 282.

12. Ibid., p. 283.

13. It is worth noting, in any discussion of creationism and physics, that in 1920 an anti-Einstein club was founded in Germany. The "Study Group of German National Philosophers," as they called themselves, offered money to anyone who would speak out against relativity and "Jewish physics." Regis, p. 21.

14. Kevles, p. 287.

15. Ibid., p. 288.

16. Regis, p. 127.

17. Ibid., p.128.

18. Kevles, p. 307.

19. Ibid., pp. 385-6.

20. Ibid., pp. 387-8.

21. Ibid., p. 391.

22. Ibid., p.421.

23. Cited in Kevles, p. 423.

24. Schram, pp. 49-52.

25. Indeed, at least as late as 1986, the Institute for Advanced Study in Princeton was still receiving the occasional piece of mail addressed to Einstein. Regis, p.10.

26. Taubes.

27. Ibid.

28. It's not clear, even now, the extent to which physicists realize this is necessary. At a meeting of the Division of Particles and Fields of the American Physical Society held almost a year after the SSC's demise, speakers discussed what could have been done differently. "We speak a different language from that of people outside our field—a language that must be articulated by mathematics," said Dr. Julia Thompson, an organizer of "outreach groups" of physicists who seek to reduce public alienation. Perhaps her remarks were unfairly truncated by the reporter; however, it seems that not much progress can be made if those who seek to reduce alienation also insist they must speak another language. See "Physicists Ponder Life After the Demise of the Super-collider," by Malcolm W. Browne, in *The New York Times*, 9 Aug. 1994, p. C-5.

29. Schodolski.

30. Kevles, p. xxv.

31. Barone and Ujifusa, pp. 58, 917.

32. Hotz and Hart.

33. Faulkner.

34. See Humphreys.

35. Institute for Creation Research, "Tenets of Creationism."

36. Faulkner.

37. See Ross, *Creation and Time*.

38. See Ross, *The Creator and the Cosmos*, p. 11.

39. Institute for Creation Research. "Short History of ICR."

40. Gilkey, pp. 272-73.

41. Van Campen.

42. Malone and Schaver.

43. Ibid.

44. Van Campen.

45. Jacobson.

46. Shribman.

47. Ibid.

48. Arkansas.

49. Ibid.

50. Overton.

51. Ibid.

52. "Evolution-Only Policy in Schools."

53. Coalition for Excellence in Science and Math Education.

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The Challenge of Science to the Thinking Church

by Arthur Peacocke, S.O.Sc.
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The author looks at the state of the contemporary relationship between science and theology and reminds all concerned that neither discipline ought to claim exclusivity as the way of knowing all about the world. He shows how those who take their Christian faith seriously and with integrity need to cultivate more flexibility in their understanding of doctrine and scripture, particularly those passages whose power has been shown to lie in the symbolic and the mythical, rather than the literal and the physical.

Anyone who reads Dante's *Divine Comedy*, whether in the original, if so capable, or in one of the many fine English translations, cannot but be enormously impressed by the sheer synthetic power of his poetic imagination in integrating into one compelling narrative the cosmological, philosophical and theological insights of his times (1265-1321). It begins memorably in that "dark wood" of the frustrations, despair, and dereliction of his middle years:

> Midway this way of life we're bound upon
> I woke to find myself in a dark wood,
> Where the right way was wholly lost and gone.[1]

In the confusions and loss of hope of our present times we know only too well what he means. But in the story, Dante is led by the figure of Virgil, the embodiment of Human Wisdom, to the very threshold of Heaven through which he is guided by Beatrice, the representative of all those agencies which have become for humanity "the God-bearing image, the revelation of the presence of God."[2] She finally leads him to that sublime ultimate vision of "The love that moves the sun and the other stars." For most of us moderns, including post-moderns, this is a vision for which we may well yearn but do not expect to be consummated. For that human wisdom, which was personified by Virgil and which today is dominated by the natural sciences, no longer leads us so unambiguously to the threshold of the divine.

The process of disruption of this unitary vision was beginning to be discerned later when John Donne, the English divine and poet, wrote in 1611:

> And new philosophy calls all in doubt,
>
> Tis all in pieces, all cohærence gone.[3]

In this we hear an echo of the desolation that was felt at the loss of an awareness of organic unity, "Tis all in pieces"—of a divine placement for humanity, and indeed of all things living and non-living, in an organic whole.

After the seventeenth century, nothing could stem the rising tide of an individualism in which the self surveyed the world as subject over against object. This way of viewing the world involved a process of abstraction in which the entities and processes of the world were broken down into their constituent units. These were conceived as wholes in themselves, whose lawlike relations it was the task of science to discover. The staggering success of these procedures cannot be overestimated. In the course of 300 years, they have altered the whole perspective of

Western humanity so that the historian Herbert Butterfield, in his introduction to some Cambridge lectures in 1948, could declare that the scientific revolution "outshines everything since the rise of Christianity and reduces the Renaissance and the Reformation to the rank of mere episodes, mere internal displacements, within the system of medieval Christendom."[4] It is the impact of this revolution on religious belief in general, and in particular on Christianity, which bore and still bears the brunt of it, that is our concern here.

We have to take into account that the media still propagate, almost unconsciously, a "warfare" model of the relation of science and religion, as evidenced every time the British Association for the Advancement of Science meets, when gleeful, and historically inaccurate,[5] accounts of the encounter at its 1860 meeting between T. H. Huxley and the then Bishop of Oxford, Samuel Wilberforce, unfailingly appear. To this day it is still not regarded as professionally respectable for a biologist to admit to being a Christian. In Britain, not long ago, we witnessed a contemporary biologist, Richard Dawkins, in the role of Huxley-redivivus, attempting scornfully to denounce religion, as represented by the then Archbishop of York, Dr. John Habgood. The occasion was the Edinburgh International Festival of Science (April 1992), and it was interesting to observe the anti-religious and biased reporting it received from the science correspondents of the more up-market newspapers. This provoked articles and counter-articles, letters and comments in the other media, showing that "science versus religion" was still regarded as a newsworthy sport. The proper concern should be, of course, with the actual state of their relationship. For it is as true today as it was some 60 years ago, when A. N. Whitehead, the mathematician-philosopher, considered that the future course of history would depend on the decision of his generation as to the proper relations between science and religion—so powerful were the religious symbols through which men and women conferred meaning on their lives, and so powerful the scientific models through which they could manipulate their environment.[6]

In spite of several decades of sophisticated and informed analyses of the true contemporary state of the complex and subtle relationships between science and religion, the idea that it is a state of conflict still endures in the popular mind. Thus, most young people in England and Scotland reported, in some recent thorough studies, that, one way and another, they had given up "religion" because of "science."

As we read, for example, the reports of the debate between Richard Dawkins and Archbishop Habgood, we cannot avoid realizing that different perspectives are operating in the arguments, concerning the actual status of scientific and religious affirmations and what counts as evidence for them. A vital aspect of the supposed challenge of science to religion is indeed to sort out how they differ with respect to the *kind of knowing* they each represent—and this is as much a challenge to science as it is to religion.

A vital aspect of the supposed challenge of science to religion is indeed to sort out how they differ with respect to the kind of knowing they each represent—and this is as much a challenge to science as it is to religion.

In a post-modern age, science itself has come under attack as being sociologically and ideologically conditioned, even with respect to the knowledge it asserts to have of the world. Religion, of course, has long

had to suffer such attacks and the impugning of its claimed knowledge of God and humanity. The presuppositions of what I say here will be "critically realist" with respect to both science and theology. That is to say, I think that both science and theology *aim* to depict reality, that they both do so in metaphorical language with the use of models, and that their metaphors and models are revisable within the context of the continuous communities that have generated them.

This philosophy of *science* has the virtue of being the implicit, though often not articulated, working philosophy of practising scientists, who aim to depict reality but know only too well their fallibility in doing so. A formidable case for such a critical scientific realism has, in my view, been mounted,[7] based on the histories, for example, of geology, cell biology and chemistry, which during the last two centuries have progressively uncovered hidden structures in the entities of the natural world that account causally for observed phenomena. Note that this view asserts only that it is the *aim* of science to depict reality as best it may—it is, rather, a *program* for the natural sciences. Models and metaphors are widely used in science; but this practice does not detract from the aim of such language to refer to realities, while it does entail that these models and metaphors are always, in principle, revisable.

Now *theology*, the intellectual formulation of religious beliefs and explication of religious experience, also employs models which may be similarly described.[8] I urge[9] that a critical realism is also the most appropriate and adequate philosophy concerning religious language and theological propositions: theological concepts and models should be regarded as partial inadequate and revisable, but necessary and, indeed, the only ways of referring to the reality that is named as "God" and to God's relation with humanity. Models and metaphors play an even more obvious role in religious language than in science. In theology as in science, we have also to attempt to infer to the best explanation by application of the normal criteria of reasonableness: fit with the data, internal coherence, comprehensiveness, fruitfulness and general cogency.[10]

It is the aim of theology to tell as true a story as possible. Like science, it too must allow gradations in the degree of acceptance, in the belief in the "truth," of theological propositions, and must recognize that there is a hierarchy of truths, some more focal and central (and defensible) than others. The whole theological enterprize has often been criticized because it has been said to have no way, comparable in rigor to that of science, for the sifting and testing of its "data"—in this case, the content of religious experience and tradition and the scriptures that preserve some of them. However, some philosophers of religion have in fact been able to mount what seems to me to be an effective defense of the warranty of religious belief as expressed theologically.[11] For theology, like science, also attempts to make inferences to the best explanation—or, rather, it *should* be attempting to do so. In order to carry this out, theology should use the criteria of reasonableness already mentioned, for these are criteria which at least have the potentiality of

I think that both science and theology* aim *to depict reality, that they both do so in metaphorical language with the use of models, and that their metaphors and models are revisable within the context of the continuous communities that have generated them.

leading to agreement between people of different traditions (even within Christianity). Some signs that this might not be an entirely forlorn hope are provided by the changes that were at least initiated in the Roman Catholic Church by Vatican II, by the development during this century of the World Council of (non-Roman) Churches, and by the dialogues that are beginning to be organized among the world's major religions.

The need now is for theology to develop the application of its criteria of reasonableness in a community in which no authority would be automatic (for example, of the form "the Church says" or the Bible says," for all such arguments are circular). Truths that are claimed to be revealed or are the promulgations of ecclesiastical authority must not be exempted from running the gauntlet of these criteria of reasonableness, for they cannot be at the same time both self-warranting and convincing. This approach needs to be combined with an openness to development as human knowledge expands and experience is further enriched. When I urge this kind of critically realist aim and program on Christians, and indeed on the adherents of all religions, I cannot help feeling a little like theologian and Archbishop of Canterbury, William Temple (1881-1944), who is reputed to have said, "I pray daily for Christ's one holy, catholic and apostolic Church—and that it may yet come into existence."[12] That could also be said of the present situation of a critical-realist theology. It has broadly the same intentions as that described by Hans Küng[13] as "truthful," "free," "critical," and "ecumenical"—a theology that deals with and interprets the realities of all that constitutes the world, especially human beings and our own inner selves.

Now, in spite of what the "cultured despisers" of Christianity might say, there are "data" available to the theological enterprise, just as there are to the scientific. They are constituted by the well-winnowed traditions of the major world religions, among them Christianity, which provides our principal source in the West of tested wisdom about how to refer to that which is encountered in those experiences initially dubbed as experiences of God. In this perspective, both science and theology are engaging with realities that may be referred to, and it is therefore entirely appropriate to ask how what scientists believe about the natural world and what religious people believe about God and human nature might, or should be, related—as they always have been in the history of both of them.

I began by referring to Dante's unified vision of nature, humanity, and God. What is the vista that twentieth-century science unveils for our contemplation? We know now that we live in a world that, extrapolating backwards in our clock-time, may be said to have "begun" some ten or so billion years ago in the fluctuation of a quantum field that became an unimaginably condensed mass of fundamental particles and quanta of energy, and that has over millions of years coalesced, in an expanding space, into the present observable universe, with its billions of galaxies, each containing between a hundred million and a hundred thousand million stars. Near one of these stars in one of these galaxies, one planet—our Earth—had a composition, temperature and age such as to allow the formation of increasingly complex molecules from the atoms it had inherited from some supernovae explosion eons before. By their inherent properties, some systems of molecules came into existence that could copy their own patterns of organization—matter became living. The forms of living matter expanded by the incorporation into their systems of other molecules, and in doing so competed with each other for limited resources. Those life forms that produced the most copies of themselves at any one time persisted longer than others, and the evolution of living organisms by natural selection was under way. The advantage of acquiring new functions and abilities, in response to changing conditions of climate and the predations of other living organisms,

stimulated an increase in complexity as time proceeded. We note that the history of the cosmos and of life on the Earth manifests an emergent quality—for the concepts that are hammered out by the sciences appropriate to each level of complexity, and that are needed to describe and account for specific systems, cannot be reduced to those that are pertinent to their constituents. Genuinely new kinds of reality appear in the evolutionary process, in the course of time.

The advantages of accurate information-processing systems to predict and adjust to environments induced the development of sensitive monitoring and information-storing systems—in fact, senses, nerves and brains. This advantage could be further compounded by social communication and organization; thus, language, and, so, forms of consciousness, emerged under pressures of natural selection in those creatures capable of such information retrieval. These propensities toward complexity, information-processing, and consciousness eventually coalesced in the uniquely concentrated form of the personal self-consciousness of *Homo sapiens*, who, be it noted, might have exemplified the embodiment of these propensities in a quite different physical form, such is the interplay of chance and law, of sheer happenstance, in the evolutionary process. Thus, the original fluctuation in a quantum field has taken the form of human persons with all their creativity and diversity. The dust of the cosmos has become a Mozart, a Shakespeare, a Jesus of Nazareth—and you and me! What might a latter-day, twentieth-century Dante make of *that*?

Truths that are claimed to be revealed or are the promulgations of ecclesiastical authority must not be exempted from these criteria of reasonableness, for they cannot be at the same time both self-warranting and convincing.

The humanity that has thus come into existence through this seamless web of evolutionary natural processes, as now unveiled in broad outline by the sciences, seeks urgently and even passionately for the meaning of its own existence and of that from which and within which it has emerged. This long search for meaning is the religious quest of humanity and cannot but be affected by this new scientific perspective of where we have come from and the processes that have resulted in us being here at all. This is the broad challenge of science to religion—and indeed to all human reflection on our nature and destiny.

So, I want to look at some of the challenges to certain central themes in religious belief and consider what revisions of religious images and metaphors might be the best way of responding to them.

God

The primary attribute of God in the monotheistic religions is that of "transcendence" over all-that-is, God having a mode of being distinct from everything else. This is based on the sound instinct that the existence of all-that-is is not self-explanatory. Even the original quantum fluctuation, from which our observable universe is currently thought to have expanded, had to have a mode of being of a kind to which quantum mechanics could specifically apply, so that it had to be a fluctuation in a "field" of a kind describable by the laws of that science. It was not just "nothing at all," even if it was "no thing"! The affirmation of the existence and transcendence of God is, then, a response to the question, Why is there anything at all? A response to the sheer givenness of it all—and the need for such a response—is enhanced by the scientifically perceived subtlety and rationality of the observed universe. This response involves the recognition of God as Creator, as the giver of being

to all-that-is, as the ground of all being, as Being itself, and the recognition of the world as having a derived and dependent being. This constitutes one of the fundamental pillars of Christian theology, and indeed of all the monotheistic religions.

The givenness of the parameters of the universe has been brought sharply into focus recently in that cluster of physical considerations referred to as the "Anthropic Principle": the fact that this universe is characterized by a particular set of laws and fundamental constants that prove to be just those that could allow the development of living matter, of life, and so of ourselves. The Anthropic Principle re-emphasizes, firstly, what in the monotheistic religions of the world is perceived as the contingency of all-that-is. Everything could have been otherwise; it need not have been at all in the form it now has. Hence, the Anthropic Principle gives new grounds for us to recognize the contingency of our own existence and, so, of God's transcendence—though I myself am less sure that it actually constitutes an argument for God's *existence*. Secondly, it restores for our generation a sense of how integrated is our human existence with the physical cosmos, that cosmos whose sheer scale seems, on our first apprehension of it, so daunting—threatening even. Not only is this Earth our natural home, so is this universe!

There seems to be an in-built tendency in matter toward complexity, self-organization, information transfer—and ultimately toward consciousness, cognition, and self-consciousness. The original "hot Big Bang," with its cloud of neutrinos, quarks or whatever, has become us.

In twentieth-century physics there has been a development, initiated by Einstein, in which the categories of space and time, which seemed so given and *a priori* to Kant—and to "common" sense—are themselves interlocked with each other in a new kind of relation. For space, time, matter and energy have become mutually defined concepts that modern physicists link closely together. This challenges naive understandings of the doctrine of creation. For any notion that God gives being to all-that-is must now include time as an aspect of, a real relation within, what God has created, as St. Augustine of Hippo well knew. Our understanding of the doctrine of creation is restored to what the profoundest thinkers in the monotheistic religions have always affirmed: that it is not a statement about what happened "in" space-time, because space-time, matter, and energy are all aspects of the created order. God has to be regarded as other than, and transcending, the space-time, matter, and energy of the physicists. The doctrine of creation is fundamentally about the relation of God to all-that-is, and this includes space-time-matter-energy. It is not at all about what happened at 4004 B.C.E., or even 10 billion B.C.E.!

But, together with the biblical authors, Christians, Muslims and Jews believe that God is not entirely "timeless," for they all regard God as, in some sense, "personal"—as least misleadingly described by personal metaphors, and as interacting with human beings in a way best understood as like personal relationships. So God is pictured as experiencing a sense of succession in relation to the world, including human beings. We cannot put God, as it were, on a mountaintop from which God views all time—past, present and future—and, thus, foresees all future events (including those involving ourselves), for that would limit, indeed destroy, our freedom. For us to be free, God cannot know with certainty what

we will decide. There is no simple fact of the matter ("At 10.30 a.m. tomorrow, I will do X...") for God or for us to know. I would suggest that we can best think of God giving existence to all-that-is, i.e., creating moment by moment, each interval of that relation we call physical time (in our particular relativistic framework)—which is what the traditional notion of God sustaining and preserving matter-energy in space-time must now be taken to signify. That is how I and some others respond to the challenge of the modern physical understanding of space-time-matter-energy in relation to the idea of God as Creator.[14]

The scientific perspective also challenges and, I think, enriches our notion of another classical attribute of God in the monotheistic religions, namely, the presence of God in the world, the "immanence' of God. We observe, through the sciences, the operation of natural processes that are continuously and inherently creative, for matter has the ability to be self-organizing into new forms. The process is open-ended, and the details of the processes are often unpredictable by us and will always be so, either because of in-principle "Heisenberg uncertainty" at the subatomic level, or because of the in-practice inevitable unpredictability of the future states of certain, far-from-uncommon, nonlinear macroscopic systems. There seems to be an in-built tendency in matter, and the processes it undergoes, toward complexity, self-organization, information transfer—and ultimately toward consciousness, cognition, and self-consciousness. Potentialities appear to be being actualized. The original "hot Big Bang," with its cloud of neutrinos, quarks or whatever, has become us. Nature not only *has*, but *is* a history of events. There seems to be no inert stuff in the universe, for all entities and structures are in dynamic process in which the universe manifests emergence of the genuinely new. *New* realities go on appearing.

If we are to think of God as Creator of such a universe, then we are bound to re-emphasize that God is still *creating* in, with, and under the processes of the natural world all the time. God is all the time the Creator—it is an ongoing, continuous relation. God as Creator not only, in this perspective, sustains and preserves the world (the traditional understanding) but must now be regarded as continuously creating in, with, and under these creative processes. In unveiling the natural processes whereby new forms come into existence, science is revealing God at work as Creator. God has now to be understood as exploring and actualizing the potentialities of creation, achieving ends flexibly without laying down determinate lines in advance. God is improvising, rather as did J. S. Bach before the King of Prussia, or perhaps as does an extemporizing New Orleans jazz player in Preservation Hall. Creation is the action of God-the-Composer at work.

Moreover, in some sense, the world is "in" God, yet God is "more than" the world. God, in this respect, is more Creator-Mother than Creator-Father, for God gives new forms and life to what is *in* God, in "God herself," we find ourselves having to say. God is present to all-that-is, the circumambient Reality that flows in and around all.

Science, strangely enough, affords here some new perspectives on the perennial mysteries of death and pain and suffering. For, through our scientific spectacles, we now know that death of the individual is the pre-condition of the evolving by natural selection of new life and new forms of life. Furthermore, consciousness, and, so, awareness, cannot evolve without the development of nervous systems and sensitive recording organs, which inevitably have to be able to react negatively to their environment with what we call pain. It appears that pain and suffering are the pre-conditions of sensitivity and consciousness, and that death of the individual organism is the pre-condition for new life to appear. What religious thinkers used to call "natural evil" now appears in a new light as a necessary part of a universe capable of generating new forms of life and

consciousness. This has the corollary that, for our notion of God to be at all acceptable morally, we have to regard Godself as suffering in, with, and under the creative processes of the world, a perception now widely accepted by many Christian thinkers. God is, then, to be conceived as suffering and enduring what we call natural evil for achieving the ultimate good and fruition of what is being created, namely, *inter alia*, free-willing, self-conscious *persons*.

God and the World

But now another apparent challenge from the sciences to religious thinking must be faced. How can God be thought of as interacting with, and possibly influencing, events in a world in which all its processes and events are increasingly rendered lawlike and intelligible by the sciences, which include the brain sciences and psychology? Many people in the past have been driven to think of God as some kind of *deus ex machina*, who, from some lofty, transcendent throne, intervenes in the very fabric of the causal network that same God is regarded as having created. Oddly enough, science, in explicating what personal agency might be, now also helps to clarify how God might be conceived to interact with the world and influence events without breaking the very regularities that Godself has created.

It appears that pain and suffering are the pre-conditions of sensitivity and consciousness, and that death of the individual is the pre-condition for new life to appear. What religious thinkers used to call "natural evil" now appears as a necessary part of a universe capable of generating new forms of life and consciousness.

In the perspective of the sciences, human beings are seen as psychosomatic unities, evolving by natural processes, emerging into consciousness and self-consciousness. Biblical scholars also emphasize that this non-dualist view of the human being as a psychosomatic unity is indeed that of the Hebrew Scriptures and also underlies that of the New Testament. This view can give us an important clue to making more intelligible the belief that God interacts with the world to make some things happen rather than others. When we act, total brain states, which we experience subjectively as thoughts, intentions, purposes, etc., are causally effective in the many-tiered levels of our bodies. This action of our brains-in-our-bodies is a holistic one, in the top-down direction and what happens at the "lower" levels is entirely consistent with the known regularities of muscle biochemistry, physiology, neurology, etc. This is but one of the more significant proposed examples of the way in which the state of a whole macroscopic complex system affects and constrains the events occurring at the micro-level of its constituents parts. Many other systems are known to manifest this kind of whole-part constraint (or "top-down causation," as it has less felicitously been called).

Such systems suggest a model for how God might be conceived as interacting with the world—for how God might be causally effective in a whole-part relationship that does not abrogate the known regularities of events at their own distinctive level of description by the appropriate sciences. This would not be an "intervening" God, but would be a God *continuously* interacting with the totality of the world, shaping, through God's own whole-part constraint upon the whole, both the general course of events and the patterns of particular ones.[15] God is faithful to the order of God's own

creation and does not act in a way inconsistent with its God-created regularities. Moreover we now see that God has let God's own acts be circumscribed by the character of the natural order Godself has created, even including the inherent unpredictability of events at the Heisenberg level, and of those macroscopic events that result, in some cases, from the amplification of quantum ones.

As often in the past, the model of personal agency continues to be fruitful in helping to conceive of God's interaction with the world. But now it is enriched and nuanced by new insights into the brain-body relation, into whole-part constraint in complex systems, and into the openness and flexibility inherent in the natural world.

It is theologically imperative that the birth stories and the doctrine of the virginal conception of Jesus be separated from the doctrine of the incarnation and be regarded as mythical and legendary stories intending to convey non-historical and non-biological truths.

Humanity

Like all living organisms, human beings have a finite life, and we have come to recognize, through the scientific understanding of evolution, the biological necessity of the death of the individual. We as individuals would not be here at all, as members of the species *Homo sapiens* if our forerunners in the evolutionary process had not died. Biological death was present on the Earth long before human beings arrived on the scene and is the prerequisite of our coming into existence through the processes of biological evolution, whereby God creates new species, including ourselves. So when St. Paul says that "sin pays a wage, and the wage is death" (Rom. 6:23), that cannot possibly mean for us *now* biological death and can only mean "death' in some other sense, such as the death of our relation to God consequent upon sin. I can see no sense in regarding biological death as the consequence of that very real alienation from God that is sin, because God had already used biological death as the means for creating new forms of life, including ourselves, long before we appeared on the Earth. This means those classical Christian formulations of the theology of the redemptive work of Christ that assume a causal connection between biological death and sin urgently need replacing.

Moreover, the scientific evidence is that human nature has emerged only gradually by a continuous process from other forms of primates, and there are no sudden breaks of any substantial kind in the sequences noted by paleontologists and anthropologists. There is no past period for which there is evidence that human beings possessed moral perfection existing in a paradisiacal situation from which there has been only subsequent decline. All the evidence points to a creature slowly emerging into awareness, with an increasing capacity for consciousness and sensitivity and the possibility of moral responsibility and, the religions would affirm, of response to God. So there is no sense in which we can talk of a "Fall" from a past perfection. There was no golden age, no perfect past, no original perfect, individual "Adam" from whom all human beings have now declined. What is true is that humanity manifests aspirations to a perfection not yet attained, a potentiality not yet actualized, but no "original righteousness". Sin as alienation from God, humanity and nature is real and is about a falling short of what God intends us to be and is concomitant with our possession of self-consciousness, freedom and intellectual curiosity. The

classical conceptions of the "Fall" and of "sin" that dominate Christian theologies of redemption urgently need, it seems to me, recasting if they are to make any sense to our contemporaries.

Now, we all have an awareness of the tragedy of our failure to fulfill our highest aspirations; of our failure to come to terms with finitude, death, and suffering; of our failure to realize our potentialities and to steer our path through life. Freedom allows us to make the wrong choices, so that sin and alienation from God and from our fellow human beings are real features of our existence.

So, not only the question, Who are we? but even more acutely, What should we be becoming? and, Where should we be going? remain acute for us. To be brief, I find the clue to the answers to these questions in the person of Jesus of Nazareth. As Irenaeus affirmed, "The Word of God, Our Lord Jesus Christ, who of his boundless love became what we are to make us what even he himself is."[16] So, then, this question presents itself:

Who is Jesus?

Viewed against the backcloth of the vista of cosmological and biological evolution that the sciences now give us, how is this question to be answered?

Since 451 C.E., the Definition of Chalcedon has been taken as the criterion of orthodoxy. It affirmed that Jesus was "complete in regard to his humanity," that is, "completely human"—indeed "perfect" in the sense of "complete"[17]—fully human, but (note) *not* necessarily displaying perfection in all conceivable human characteristics. Any assessment of Jesus must start here, along with recognizing his special vocation and relation to God.

But, one may well ask, isn't this starting point in Jesus' undoubted humanity called into question by the assertion in the traditions about Jesus, that there were acts of his and events associated with him that have a "supernatural" connotation? Consider, for example, the supposed "miracles"? If by "miracle" one means an event interpreted as not fully explicable by naturalistic means, then judgment must depend on one's *a priori* attitudes toward the very possibility of such events occurring in principle—and a scientific age is, in my view, properly skeptical. Briefly, I consider[18] that, in general, the healings and apparent exorcisms give rise to no special difficulties, even for a scientific age, but that the "nature miracles" certainly do so. These latter usually have features that denote them either as pure legend or as stories told with an overload of symbolic meanings—in fact, "myths" that are true!

More pertinent to the theme are the major "miracles" connected with the person of Jesus himself.[19] Firstly, as regards the birth narratives, found in the Gospels of Matthew and Luke, the conclusion of Raymond Brown, the cautious and very thorough Roman Catholic scholar, is worth quoting:

> [T]he *scientifically controllable* biblical evidence leaves the question of the historicity of the virginal conception unresolved.[20]

This verdict would be regarded as over-cautious by other scholars less restrained by an ecclesiastical magisterium. Thus John Macquarrie affirms:

> [O]ur historical information is negligible...apart from...scraps of doubtful information, the birth narratives [of Matthew and Luke] are manifestly legendary in character.[21]

Biological science, in fact, also raises acute questions about the "virginal conception." Since females possess only X chromosomes, conception without a father to provide a Y chromosome could lead only to a female child with two X chromosomes, unless there was some kind of divine *de novo* creation of a Y chromosome in the ovum entering Mary's uterus—for the New Testament narratives never deny, and indeed affirm, a normal gestation period of nine months. Even such a miraculous, almost magical, act would be beset with problems: What genes should the DNA of this Y chro-

mosome possess? Those to give facial characteristics of Joseph, or, if not, of whom? So one can go on piling Ossa on Pelion.

But a more general consideration now weighs heavily with me because of its theological import. If Jesus is really to be fully and completely human, all that we now know scientifically about human nature shows that he must share both our evolutionary history and have the same multi-levelled, including genetic, basis for his personhood—and that means he must be not only flesh of our flesh and bone of our bone, but also DNA of our DNA. If he does not, to use the traditional terms, our salvation is in jeopardy for "what he has not assumed he has not healed."[22]

Those members of the Church who take no account of the scientific picture of the world are forfeiting the future viability of the Good News for humanity that is in Jesus the Christ.

Hence, it is *theologically* imperative that the birth stories and the doctrine of the virginal conception of Jesus be separated from the doctrine of the incarnation and be regarded in the same light as those about Adam and Eve—that is, as mythical and legendary stories intending to convey non-historical and non-biological truths. In this instance, the truth being asserted is that God took the initiative in shaping and creating the person and life of Jesus of Nazareth.[23]

The situation is quite otherwise with that other major postulated "miracle" concerning the person of Jesus, that complex of events we call his Resurrection (and in which I will include also the Ascension or Exaltation). It is not at all clear that the narratives, as such, of the "resurrection," are sensitive to scientific considerations at all, since the end state, the "risen" Jesus is not open even to the kind of repeatable observations that science and, indeed, ordinary experience involve. The evidence is that this was a genuine experience within the consciousness of several witnesses. Such a complex of experiences, especially when they are communal, could well manifest a new reality only discernible in that particular complex combination. The concept of "resurrection" appears not to be reducible to any purely psychological account, and the affirmations of the New Testament can properly be claimed to be referring to a new kind of reality hitherto unknown because not hitherto experienced. The sciences as such can make no comment. I recall the penetrating statement of Christopher Evans:

> The core of resurrection faith is that already within the temporal order of existence a new beginning of life from God, and a living of life under God, are possible, and are anticipatory of what human life has it in it to be as divine creation: and that this has been made apprehensible and available in the life and death of Christ regarded both as divine illumination of human life and as effective power for overcoming whatever obstructs it.[24]

Jesus' resurrection demonstrated to the disciples, notably to Paul, and now to us, that it is the union of his kind of life with God which is not broken by death and is capable of being taken up into God. For he manifested the kind of human life that can become fully life with God, not only here and now, but eternally beyond the threshold of death. Hence, his imperative, "Follow me," now constitutes for us a call for the transformation of humanity into a new kind of human being and becoming. What happened to him, Jesus saw, *could* happen to *all*.

In this perspective, Jesus the Christ, the whole Christ event, has shown us what is possible for humanity. The actualization of this potentiality can properly be regarded as the consummation of the purposes of God in the evolution of humanity. In Jesus, there was a divine act of new *creation,* because the initiative was from God within human history, within the responsive human will of Jesus inspired by that outreach of God into humanity traditionally designated as "God the Holy Spirit." Jesus the Christ is thereby seen, in the context of the whole complex of events in which he participated (the "Christ event"), as the model of what God intends for all human beings, now revealed as having the potentiality of responding to, of being open to, of becoming united with, God.

But how can what happened in and to him, there and then, happen in us, here and now? Can what happened in and to him be effectual, some 2000 years later, in a way that might actually enable us to live in harmony with God, ourselves, and our fellow human beings—that is, to experience the fulfillment for which human nature yearns?

The Work of Christ

I can here only sketchily outline how such questions might be answered in the affirmative.[25] *Any* answer, to be credible today, will have to be grounded on our sharing a common humanity with this Jesus. There are certain features in the scientific perspectives we have been delineating that now properly constrain this response, namely:

(i) The biological death of the individual, as the means of the evolutionary creation of new species by natural selection, cannot now be attributed to human "sin"; and

(ii) The evidence is all against human beings ever in the past having been in some golden age of innocence and perfection from which they have "fallen."

The Nicene Creed simply affirms baldly that Christ "was crucified *for us* under Pontius Pilate. He suffered and was buried." This reticent "for us" encompasses a very wide range of interpretations. Although the Church in its many branches has never officially endorsed any one particular theory of this claimed at-one-ment, yet a number have become widely disseminated doctrinally, liturgically, and devotionally. They all (with one exception—the Abelardian) propose a change in God's relation and attitudes to humanity because of Jesus' death on the cross. These purportedly "objective" theories of the atonement also rely heavily on those very two presuppositions I have just mentioned as no longer tenable in the light of well-founded science. Moreover, they fail to incorporate our sense, derived from the vista of evolution unfolded by the sciences, of humanity as *emerging* into individual and corporate consciousness and self-consciousness, awareness of values, social cooperation, human culture; and into a sense of and awareness of God. The classical theories of the atonement fail to express any dynamic sense of the process of human *becoming* as still going on. They also fail to make clear how the human response, which is an essential part of the reconciliation between God and humanity, is evoked.

So, let us now put the question again as: How can what happened in and to Jesus the Christ actually evoke in us the response that is needed for our reconciliation to God and actually enable us to live in harmony with God and humanity *here and now*? This question may be answered most effectively, it seems to me, by seeing the life, suffering and death of Jesus the Christ as an act of love, an act of love *of* God, an act of love *by* God.

In the suffering and death of Jesus the Christ, we now also concomitantly perceive and experience the suffering, self-offering love of *God* in action, no more as abstract knowledge, but actually "in the flesh." For the openness and obedience of the human Jesus to God enabled him, as *the* God-informed human person, to be a manifest self-expression in history, in the confines of human personhood, of God as creative, self-expressing Word/*Logos*/"Son." Thereby is uniquely and de-

finitively revealed the depth of the divine love for humanity and the cost of *God's* gracious outreach to us as we are, alienated from God, from humanity and ourselves—that is, as "sinners." As such, this love of God *engages* us, where "to engage" means "to attract and hold fast; to involve; to lay under obligation; to urge, induce; to gain, win over."[25] The Cross is a proposal of God's love and *as such* engages our response. Once we have really come to know that it was God's love in action "for us" that was manifest in the self-offering love and obedience of Jesus the Christ, then we can never be the same again. God in that outreach to humanity that we denote as "God the Holy Spirit" united the human Jesus with God's own self and can now kindle and generate in us a love for God and for the humanity for whom Jesus died, as we contemplate God in Christ on the cross.

What I am proposing here is that this action of God as Holy Spirit in us engages our response, and this itself effects our at-one-ment, is itself salvific, actually making us whole, making us "holier." Such an understanding of the "work of Christ" coheres with our present evolutionary perceptions that the specifically human emerged and still emerges only gradually and fitfully in human history, without a *historic* "Fall."

For since God took Jesus through death into his own life, it is implicit in this initiation and continuation of this process in us that we, too, can thereby be taken up into the life of God, can be "resurrected" in some way akin to that of Jesus the Christ. Since Jesus was apprehended as having been taken through death with his personhood and identity intact and as having been "taken up" into the presence of God, it *could* happen to us, and that is the ground of our hope for our individual future and that of humanity corporately.[26]

Furthermore the interpretation of the death and resurrection of Jesus as manifesting uniquely the quality of life which can be taken up by God into the fullness of God's own life implicitly involves an affirmation about what the basic potentiality of all humanity is. It shows us that, regardless of our particular human skills and creativities—indeed, regardless of almost all that the social mores of our times applauds—it is through a radical openness to God, a thoroughgoing self-offering love for others and obedience to God that we grow into such communion with the eternal God that *God* does not allow biological death to rupture that essentially timeless relation.[26] Irenaeus says it all:

> The Word of God, our Lord Jesus Christ,
> Who of his boundless love
> became what we are
> to make us what even he himself is.[27]

Conclusion

If the foregoing has any weight, then it is an example of the way that the Church must rethink its message in today's language, for a society deeply impressed by and indebted to science. The old images, although they may still be evocative and meaningful for those steeped in traditional language, no longer appear at all credible to those outside the churches and other religious institutions, which is 90% of those in the United Kingdom and most of Europe, it seems from all the surveys. We need a rebirth of images in continuity with what we have inherited from the classical religious scriptures and traditions; we need to revise how we speak of the eternal realities to which the religions seek to refer.

For I am convinced that the importance of ideas, both in the short and the long run, cannot be overestimated. Those members of the Church who take no account of the scientific picture of the world are forfeiting the future viability of the Good News for humanity that is in Jesus the Christ. They are digging themselves into a deeper and deeper hole and, as they go down, they will be able to talk more and more to themselves and less and less to other thinking people. For in God's good time, truth must prevail.

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Endnotes:

1. Dante Alighieri, first stanza.

2. Ibid., commentary by Sayers, "The greater images," vol. I, p. 68.

3. Donne, p. 73, lines 205 and 213.

4. Butterfield, p. vii.

5. For an account of the development of this particular myth, see Lucas.

6. Quoted by Brooke, p. 1.

7. MacMullin, p. 30.

8. See, among others, Soskice, ch. 7; and MacFague.

9. See, for example, Peacocke, introduction.

10. See Mitchell; Banner.

11. See Mitchell; Banner.

12. I cannot trace the reference.

13. Küng, unpublished lecture.

14. But this response is not undisputed, for mathematical physicists take very seriously—even reifying—their models of a four-dimensional "block" universe in which the future just is there already, so to speak. See the discussion in Isham and Polkinghorne.

15. This may be understood as analogous to what is technically called an input of "information." See the discussion in Peacocke, pp. 179ff; chap. 11, sections 2(a), 3(b) and 3(c); and endnote 31, pp. 416-417, discussing J. C. Puddefoot's analysis of the meaning of this term.

16. Irenaeus, V, praef.

17. Robinson, p. 68 and n. 3.

18. For a fuller exposition see Peacocke, ch. 13, section 3(d).

19. Ibid., chap. 13, section 3(e).

20. Brown, p. 527, emphasis in the original.

21. Macquarrie, pp. 392, 393.

22. Gregory of Nazianzus.

23. *En passant*, this does not, of course, derogate at all from St. Mary's unique position in Christian devotion and affection as the mother of our Lord, who must have been the primary influence on his maturation and one of the earliest witnesses to his true vocation and role—and in a very real sense, the Mother of the Church.

24. Evans, p. 503. For a fuller treatment, see Peacocke, pp. 319ff.

25. *Oxford English Dictionary*.

26. The virtue of being agnostic about the relation between the "empty tomb" and the risen Christ here becomes apparent. For, within a relatively short time after our own biological death, our bodies will lose their identity as their atomic and molecular constituents begin to disperse through the Earth and its atmosphere, often becoming part of other human beings. See the discussion in Peacocke, pp. 279-288.

27. Irenaeus, loc. cit.

A leading theologian in the science-and-religion field, Arthur Peacocke is a physical biochemist (research on DNA and biological macromolecules) and, since 1971, an Anglican priest. He has authored many books, including Creation and the World of Science *(1979), Theology* for a Scientific Age *(1990; enlarged edition, 1993),* God and the New Biology *(1986),* God and Science: A Quest for Christian Credibility *(1996) and* From DNA to Dean: Reflections and Explorations of a Priest-Scientist (*1996). He delivered the Bampton lectures in 1978, the Gifford Lectures in 1992-93, and is a founder of the Science and Religion Forum (U.K.), and founder and Warden Emeritus of the Society of Ordained Scientists, a dispersed religious order. He taught for many years at the University of Birmingham, Cambridge University, and Oxford University; and he directed the Ian Ramsey Centre, Oxford, from 1985-1988 and from 1995-1999.*

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A Modern Natural Theology?

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The author examines two different traditions of nineteenth-century natural theology and their reappearance in a modern work. Michael Denton's Nature's Destiny *is used as an example of modern natural theology, showing how current writers attempt to resurrect the classical arguments of William Paley and William Whewell. The stance taken here is that, due to the heavily historical character of Paley's and Whewell's work, it is inappropriate to use their traditions uncritically as windows into religious understandings of science.*

Despite the often-proclaimed secularization of modern science, the natural theology project endures today. Within a large wave of recent works in the genre is Michael Denton's *Nature's Destiny*, which incorporates many of the premises and arguments characteristic of this new generation of natural theologians. This book claims to hold a privileged place atop the twentieth century's impressive scientific achievements, from which the author can provide a new and persuasive argument for design that was unavailable to his predecessors. However, a careful reading reveals that Denton is doing little that is new. The crucial elements of his argument can be found in both William Paley and William Whewell (of whom he is well aware). Novelty is apparent only in a synthesis of the very different styles of those writers. But this reintroduction of their arguments is not unproblematic: Paley (1743-1805) and Whewell (1794-1866) were historical figures, and their work is understood best in the context of their production. Therefore, one should be wary of simply transplanting their ideas into the twentieth century. The object of this essay is to demonstrate how the thinking of Paley and Whewell was the product of particular historical contingencies, and to problematize the uncritical use of their works in modern natural theology.

The *Natural Theology* of William Paley, Archdeacon of Carlisle, published in 1802, set the agenda for both natural theology and its opponents in the nineteenth century. His metaphor of the watch, representing indisputable contrivance, multiplied through myriad examples, remains a fundamental part of the design argument. Around this central core, Paley constructed an elaborate and impressive proof of an intelligent creator. His proof relied on the complexity of biological life to induce awe and reverence for a designer. Paley's arguments represented the pinnacle of Enlightenment natural theology, which achieved great importance in the eighteenth century as a focal point for intellectual consensus.

Paley began his *Natural Theology* by presenting as obvious the difference between the reactions of a passerby to a rock and to a watch. The stone, of course, calls no particular notice to itself, whereas the watch evokes insistent questions. How did it come to be here? How did its parts come to work together? Who made it? For Paley, that series of questions was an inevitable progression: recognition of the watch demanded an inquiry into its origin, and its origin was in a contrived manufacture, which forced the "invincible" conclusion of a manufacturer.[1] The salient difference between the watch and

the stone was the recognition that the existence of the watch was dependent on multiple elements arranged together to create some effect. This formed the foundation for the rest of the book in that all of the manifestations of the natural world described by Paley would be analyzed in this way: What are the parts? How do they work together?

It is this contrivance that testified to the existence of a creator. But not all constructions were of equal value for the argument. He established that the mechanical parts of organisms were the most valuable for showing design, despite their relatively crude nature. Their value came from the visibility of their mechanism: since they worked through the principles of levers, ropes, and balances (which were understood well), the complexity of their arrangement was obvious. The relationships between musculoskeletal elements were specific, efficient, and useful:

> [A]t the shoulder and the hip, where the ball and socket joint allows by its construction of a rotary or sweeping motion, tendons are placed in such a position, and pull in such a direction, as to produce the motion that the joint admits. For instance, the sartorius or taylor's muscle, arising from the spine, running diagonally across the thigh, and taking hold of the inside of the main bone of the leg a little below the knee, enables us, by its contraction, to throw one leg and thigh over the other; giving effect, at the same time, to the ball and socket joint at the hip, and the hinge joint at the knee. There is, as we have seen, a specific mechanism in the bones for the rotary motions of the heads and hands: there is, also, in the oblique direction of the muscles belonging to them, a specific provision for the putting of this mechanism of the bones into action.[2]

This was compared to the effect of digestion, which, while certainly complex, acted by principles unknown in Paley's time. Therefore, the skill of design was not apparent, whereas any natural philosopher versed in mechanics could see the fantastic complexity and efficiency of the muscles and skeleton. Evidence for design came from multiplicity and interrelated function:

> [It has been] reckoned up, in the human body, four hundred and forty-six muscles, dissectable and describable; and hath assigned an use to every one of the number...there are, at least, ten several qualifications to be attended to in each particular muscle, viz. its proper figure, its just magnitude, its fulcrum, its point of action supposing the figure to be fixed, its collocation with respect to its two ends the upper and the lower, the place, the position of the whole muscle, the introduction into it of nerves, arteries and veins. How are things, including so many adjustments to be made; or, when made, how are they to be put together, without intelligence?[3]

It was no accident that Paley relied so heavily on biological examples. He spent much of his free time in the countryside, collecting plants and animals and even attempting his own dissections. Further, he read heavily in published natural history works, especially anatomy.[4] He was fascinated by the appearance of life as a vast machine, built piece by piece such that all the elements worked together without impedance. This demonstrated careful forethought and planning for the role of every animal, plant, and blood vessel.

This theme of the harmony of complex interactions placed Paley in the mainstream of eighteenth-century natural religion. The value of complexity was manifest in all aspects of his writings. For example, he hailed the British constitution as the pinnacle of government, because of its "intricate network of checks and balances, each with its own particular purpose and each contributing to the efficient functioning of the whole."[5] This theological view asserted that every element of the natural world, from plants to Parliament, was individually designed by God to fit perfectly into a system that would bring the maximum happiness to human beings.

It was this "cosmic optimism" that brought Paley under criticism in the early decades of the nineteenth century.[6] The British evangelical movement had gained momentum during the years of war with France

and the upheavals resulting from adjustment to a peacetime economy. For many in England, the world seemed to be tottering on the edge of complete disaster, and Enlightenment natural theology was too complacent for such times. Instead, a new generation of clerics was calling for a new perspective on Christianity that recognized the grim realities of a world of revolution, war, and human depravity.

Bishop Butler was an important pioneer in the new evangelical theology, arguing that the natural world was full of suffering and that the image of a world where God's beneficence was immediately evident was no longer sufficient.[7] Following in this mode of thought was a group at Cambridge University, including Adam Sedgwick and William Whewell. They were representative of a general shift away from Paley's specificity and towards hidden generalities. Along with scientists in many disciplines, biologists in this period began looking for structural unities underlying apparent differentiation.[8] The task of this new evangelical-influenced natural theology was to find the evidence of God's design that lay underneath the chaotic appearances of the natural and social worlds. In the same way that theology needed to look beyond the apparent human suffering to see a divine plan, natural theology had to search for the laws and regularities that both explained and reached past the varieties of observed phenomena.

This holds close conceptual ties to the development of Whewell's theories of scientific induction, emerging from Cambridge in the 1820s and '30s. For Whewell, the progress of science was driven by those who were able to develop systematic and regular laws, exemplified by Newton's law of gravitation, in which the movements of all celestial and terrestrial bodies were unified. The inductive project asserted that such laws could be found in all things:

> The changes of the winds and skies, seemingly so capricious and casual, are produced by the operation of the sun's heat upon air and moisture, land and sea; and though in this case we cannot trace the particular events to their general causes, as we can trace the motions of the sun and moon, no philosophical mind will doubt the generality and fixity of these rules by which these causes act.[9]

These laws were ubiquitous, because they were the means by which God governs the universe. Induction, in effect, allowed one to reverse engineer God's designs. For this new methodology, natural theology needed to look for hidden laws. Divine evidence was seen in simple means doing things "so extensive and so beneficial."[10] Thus, it was not simplicity in itself that reveals the creator, but the ability of simple laws to govern myriad phenomena.

Paley's arguments represented the pinnacle of Enlightenment natural theology, which achieved great importance in the eighteenth century as a focal point for intellectual consensus.

For Paley, it was the vast interrelations between these phenomena of the natural world and the demonstration of their complexity that provided the best evidence for a creator. It was on these grounds that he rejected astronomy as useful: the motion of the planets and stars is too simple, without any observable mechanism to demonstrate complex design.[11] Natural laws were not useful for natural theology, because they do not show a "correspondence of parts."

William Whewell took up Paley's challenge to the utility of astronomy in the very first pages of his Bridgewater Treatise on *Astronomy and General Physics*. It is revealing that beyond responding to an attack

on the discipline, Whewell seemed compelled to defend the fundamental premise of Newtonian astronomy—the existence of natural laws—because he was setting out an improvement for advancing the argument from design. His agenda was to demonstrate how the astronomer's view of the world better harmonizes with belief in a governing deity.[12] He implicitly rejected the sufficiency of the natural theology of complexity.

The theological fingerprint in physics and astronomy was to be found in the conclusion that physical laws were of the "best" form possible, perfectly adapted to the role they played in the universe. There were two aspects to the characterization of laws as better or worse: the nature of the connection between the laws and matter, and the magnitude of that connection. The latter claim is simply that if parameters such as the gravitational constant were to hold values different from what they actually are, the universe would be unfit for life (for example, the solar system as we know it would be unstable). The precision and constancy of these values was said to demonstrate the conscious choice of a designer.

Magnitude was dealt with quickly, and Whewell spent most of his energy discussing the nature of physical laws. A law was revealing of intelligent design when it manifested the greatest possible simplicity. He argued that Newton's law of gravity, for example, appeared to have been "established by an intelligent and comprehensive selection" out of all possible gravitational relations, because it allows for stable, aesthetic and simple orbits.[13] Further, it allowed spherical masses to be treated as point particles, making analysis far simpler than if each mass element had to be treated separately.[14] Simplicity also appeared in the universality of laws. A law of gravity that held true everywhere in the universe, for all stars and planets, was clearly superior to, say, a pair of laws applicable to different situations. Whewell wanted to evoke the reader's admiration for a creator that could govern the entire universe with the simplest of rules.

Whewell's ability to root design in hidden laws allowed a continuation of the natural theology project. God's skill in creation lay in achieving maximum effect from minimum effort. Simplicity and economy were the hallmarks of divinity.

Eventually, Whewell returned to the role of human beings. He noted that the simplicity and efficiency of physical law were vitally necessary for the maintenance of life, especially civilization. His work pointed theologians toward the genius of simplicity instead of epiphenomenal complexity, thus reassuring his evangelical contemporaries that natural religion was a meaningful project, even in those unsettled days.

The split between these two schools of natural theology was firmly historical. Paley was a child of the Enlightenment, and Whewell needed to forge a new path for the darker times of pre-Reform England. Although their arguments were embedded heavily in historical context, they have survived to the present day and reappeared in the current resurgence of interest in the religious significance of science. This upsurge of natural theology at the end of this millennium is fueled by contemporary scientific topics such as genetic science and Big Bang cosmology, which are held up as new and overwhelming proof of a creative designer.

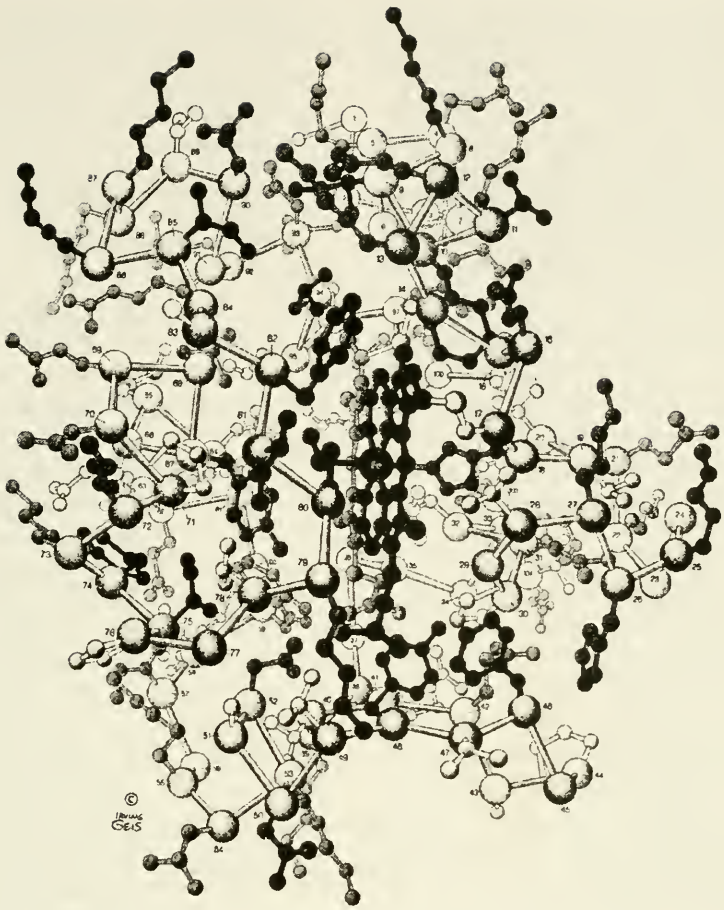


Figure 1. The atomic structure of the protein cytochrome.

What is truly new here? To answer this question, one can look to Michael Denton, a geneticist who provides an excellent example of those who claim a privileged position from which to discuss these issues. He has read both Paley and Whewell, explicitly quoting the former at times and often alluding to the later. However, he wants to set himself apart from his predecessors and claim that his access to modern scientific knowledge allows him to reach conclusions that were unavailable in the nineteenth century. Methodologically, he begins in a manner similar to Paley. He, too, is concerned with mechanisms, but of a biochemical sort. Instead of describing the intricate mechanisms of finger joints and blood vessels, he relates the complexities of DNA replication and protein structure [Figure 1].[15] He is also fond of the fantastic structure of the brain:

> Estimates of the total number of connections in the human brain...revealed that each cell may make up to 10,000 connections with other neurons. The brain of man, for example, contains about 10^{11} nerve cells, which make between 10,000 and 100,000 connections with other cells, making a total for the brain of about 10^{15}, or 1 quadrillion connections. There are certainly more connections in the brain than there are cells in the body.[16]

Like Paley, Denton believes one can see evidence of design in the interrelationship of various components. He shows that the balance of oxygen levels in Earth's atmosphere is maintained only by a fantastically complex feedback system among plants, animals, and geology.[17] His point is that a randomly evolved planet would not have developed this delicate balance

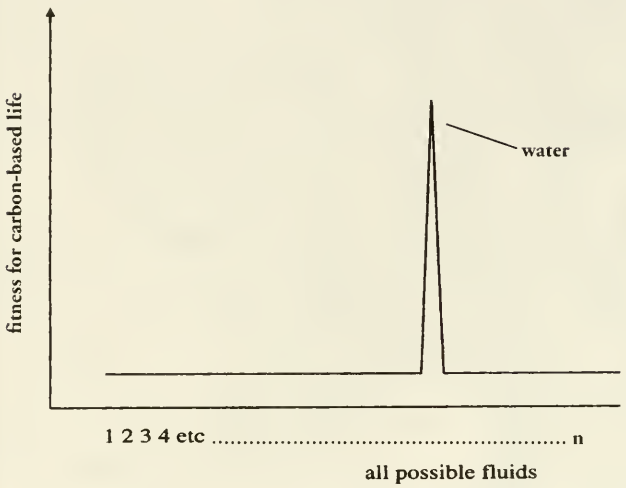


Figure 2. Example of Denton's fitness graphs, this one showing the unique fitness of water.

and the suitability of our atmosphere for life and civilization is therefore evidence of design. In a sense, he is simply extending Paley's classic watch argument to the much more complex world of chemical mechanisms.

However, he also integrates Whewellian elements into his analysis. He examines physical and chemical laws, showing that their operations are perfectly suited for the development of life.[18] This is based on quantitative analyses of possible configurations of biochemistry and biological structure, and demonstrating that the only laws that would allow life are those that actually appear in out universe:

> In short, the laws of physics are supremely fit for life and the cosmos gives every appearance of having been specifically and optimally tailored to that end: to ensure the generation of stable stars and planetary systems...to make certain that the great evolutionary drama of life's becoming will inevitably be manifest sometime, somewhere on an earthlike planet.[19]

Physical laws (such as thermal diffusion and the solar spectrum) are arranged in the precise and unique way that allows humans to exist. He draws the image of a creator able to guarantee the appearance of humankind by the correct choice of simple (i.e., fundamental) physical relations. Like Whewell, he wants a God that can manifest complexity through simplicity. For Denton, too, the key to unlocking God's secrets is in finding the underlying unities in disparate investigations:

> Advances in chemistry, biochemistry, physiology and molecular biology, commencing at the beginning of the last century but mainly in the last fifty years, have revealed an additional set of mutual adaptations and coincidences in the chemical and physical properties of water and in many other of the key constituents of life.[20]

All three of these authors want to evoke a masterful, omniscient god that is capable of supreme design. Paley's God is manifest in extraordinary and perhaps unfathomably complex parts working in concert, an idea rooted in both the ideals of the eighteenth century and his own fascination with natural history.

At the time when he was writing, an amazing amount of biological data had been collected, but there were few useful organizing principles to explain the apparent diversity and interdependence. The world appeared as a machine built piece by piece, in which the genius of the designer was in creativity and multiplicity. Divinity was in the precision of complexity.

Whewell and the natural philosophy community, however, were aware of the power of a few (relatively) simple laws to explain the vast range of phenomena. The fundamentals of reality were buried beneath phenomena in inductive explanations that took the form of mathematical laws. Further, the religious context of the 1820s and '30s demanded an explanation of how a benevolent God could have caused such chaos. Whewell's ability to root design in hidden laws allowed a continuation of the natural theology project. These laws were the tools used to build the world, and, therefore, they still provide access to God, while Paley's faith in complexity failed to do so. God's skill in creation lay in achieving maximum effect from minimum effort. Precision in laws was key: simplicity and economy were the hallmarks of divinity.

Denton has access to the intersection of the natural history and natural philosophy traditions in the form of modern genetic theory and biochemistry/biophysics. He tries to recapitulate Whewell's argument with the vastly more powerful physics available to him, and is able to relate the importance of simple, precise physical laws directly to the existence of human beings. He thus brings an immediacy to the argument that Whewell lacked. His writing continually stresses the astounding precision of these laws and the necessity of that precision for higher life. To this end, he skillfully uses graphs plotting biological fitness against various physical parameters [Figure 2].[21] These feature a line lurking at zero fitness for virtually all possible arrangements of, for example, biochemistry, and suddenly lurching upward to a peak at the point representing actual human design. These are extremely effective rhetorical tools for evoking the desired sense of astonishment at the uniqueness of human existence.

However, Denton seems unable to resist the appeal of the traditional and powerful structure of Paley's argument from design. He relapses into a classic complexity-implies-design-implies-designer formula, essentially returning to the strategy of the nineteenth century. Despite his claim of modernity, the roots of his work are firmly embedded in centuries of traditional natural theology. He uses arguments that emerged from specific and contingent historical contexts.

If natural theology is to succeed in contemporary times, it must develop strategies tailored to the current intellectual and social realities. While Paley and Whewell were highly influential, their success was tied to environments that are now hundreds of years old, and they make awkward foundations for any "new" natural theology.

In the past, natural theology has been an important force for the stabilization of the relationship between science and religion, and it may prove useful in bridging the current gap between the two. If modern scientists are going to continue this tradition, it will be necessary to follow Whewell's example and discard the strategies of the previous generations in favor of novel arguments better suited to the contemporary intellectual and social climate.

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3. Ibid., p. 105.
4. LeMathieu, p. 76-78.
5. Ibid., p. 141.
6. Hilton, p. 4.
7. Ibid., p. 167.
8. Brooke, p. 221.
9. Whewell, p. 4.
10. Ibid., p. 238.
11. Paley, pp. 258-59.
12. Whewell, pp. 1-5.
13. Ibid., p. 215.
14. Ibid., p. 220.
15. Denton., p. 170. Figure from *Biochemistry*, by Geoffrey Zubay, 2/e, ©1989. Reprinted by permission of Prentice Hall, Upper Saddle River, N.J.
16. Ibid., p. 347.
17. Ibid., p. 129.
18. Note that this is the reverse of conventional evolutionary thought, in which the structure of life adapts to the prevailing environment.
19. Ibid., p. 14.
20. Ibid., p. 17.
21. Ibid., p. 46. Used by permission of Michael Denton.

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A Critical Review of Ian Barbour's Analysis of Discussions on the Mind/Body Problem

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The concepts of mind, soul, and consciousness are key to an understanding of ourselves and how we interact with the universe around us. Ian Barbour names the mind/body problem as one of the major subjects of long-term discussion among religion, philosophy, and science, including cognitive psychology. However, his treatment of the traditional philosophical positions on this topic is wanting. What is most intriguing is that, after years of discussion, newer approaches to the mind/body problem seem to have come full circle, sharing many commonalities with the much older approach of property dualism.

> And here are trees and I know their gnarled surface, water, and I feel its taste. These scents of grass and stars at night, certain evenings when the heart relaxes – how shall I negate this world whose power and strength I feel? Yet all the knowledge on earth will give me nothing to assure me that this world is mine. You describe it to me and you teach me to classify it. You enumerate its laws and in my thirst for knowledge I admit that they are true. You take apart its mechanism and my hope increases... What need had I of so many efforts? The soft lines of these hills and the hand of evening on this troubled heart teach me much more.
>
> —Albert Camus,
> *The Myth of Sisyphus*, 1942[1]

Introduction

How can the view that the world is made of mindless physical particles be reconciled with the intuitive perception that human beings have rational, free, and independent minds? Does neuroscience threaten the notion of "soul"? Can the "mind" be identified through closer examination of the brain—to "enumerate its laws" and "take apart its mechanism"? These are but a few of the questions fundamental to a true understanding of our psychology and ourselves, questions that underlie the discussions among science, religion and philosophy on what has become known as the "mind/body problem."

The Aristotelian world did not require nor consider a distinction of mind from body. However, mental events began to be viewed differently following the scientific revolution of the sixteenth and seventeenth centuries. While his elder contemporary, Galileo, was dislodging humankind from its central position in the physical universe, Descartes offered a model for maintaining the dignity and special status of human beings. According to Descartes, the pineal gland, a pea-sized sphere near the middle of the brain, serves as junction box between one's physical body and non-physical mind.[2] In the following centuries, the idea of a rational mind that resided outside of the mechanistic world would help to ensure that the determinism inherent in Newton's physics did not extend to human-related concepts of free will and morality.

Despite its broad acceptance, the ghost-in-the-machine position of dualism does not come cheap. The notion of a causal rela-

tionship between the two radically different entities is fraught with epistemological problems. Mental events are held to be nonspatial, yet at the same time they are believed to have influence on the spatially extended physical body. How, then, do mental phenomena, such as feelings, thoughts, sensations and intentions, result in the movement of one's hand or perspiration on one's brow?

Descartes attempted to solve this problem by hypothesizing the existence of a "transducer" in the pineal gland. We now know that the pineal gland serves no such function. Moreover, such a solution merely begs the question, by offering a metaphysical substance that can interact with both physical and mental entities. To date, no such substance has been identified. Although several thinkers had suggested that the mind is reducible to the activities of atoms, the separation of mind and matter was a principle that received wide acceptance by philosophers, theologians, and the general public of Descartes' age and long after.

While his elder contemporary, Galileo, was dislodging humankind from its central position in the physical universe, Descartes offered a model for maintaining the dignity and special status of human beings.

Referred to as the "mind/body problem" by Western scholars, a broad range of positions has been developed regarding the mind and its relationship to the physical body. Each position has its strengths and its own set of inherent difficulties; I do not intend to summarize the arguments for and against each position. Rather, I offer here a critique of Ian Barbour's analysis of the more important treatments of the mind/body problem, as presented in his book, *Religion and Science*. I shall expand the discussion in key areas by providing a more detailed account of the range of proposed solutions to the mind/body problem, and I shall challenge what I believe to be a number of over-generalizations and mischaracterizations within Barbour's presentation.

Alternative Views of the Mind

Barbour identifies dualism, materialism, two-aspect theories, and multilevel theories as the four main alternatives regarding the mind/body relationship.[3] Regarding his analysis, I lay out brief arguments in support of the following claims:

- that Barbour's characterization of dualism is overly simplistic;
- that his category of materialism omits important details and includes others that should be elsewhere;
- that a separate category of philosophical behaviorism might be appropriate;
- that his two-aspect theories category is a mixing of property dualism and philosophical behaviorism; and
- that the range of positions might better be characterized as a circle, rather than a linear continuum.

Dualism

While Barbour presents dualism as a single concept, most philosophers draw a distinction between substance dualism and property dualism. It is the former that is most commonly associated with Descartes and to which Barbour appears to be referring, when writing about dualism.

In an effort to rid himself of unsupportable ideas, Descartes systematically challenged each of his own thoughts and beliefs.[4] He concluded that his belief in his own existence as a thinking entity remained as the only

belief beyond doubt ("*Cogito ergo sum*"). Because one can doubt the existence of one's own body but not that one is a thinking mind, Descartes reasoned that there must be a radical difference between these two types of substances. The substance dualism position is distinguished by its view of minds as wholly separate, nonphysical entities, distinct from and independent of the physical body. A popular version of this position holds that the mind resides within the body's physical machinery; specifically, the mind is inside the head and intimately interacts with the brain.

Property dualism does not postulate separate physical and nonphysical substances, but rather a brain with properties unlike those of any other physical structure. These properties cannot be adequately described by reducing the mind to physical mechanisms. For the most part, the properties of conscious intelligence are forever beyond the purview of the sciences.

While Barbour presents the concept of epiphenomenalism as a form of materialism, I agree with Churchland[5] that it is more appropriately classified as one of the forms of property dualism. Simply put, epiphenomenalism suggests that mental events ride "above" (*epi-*, in Greek) the phenomena of the brain. The mind is like a layer of oil on the surface of the ocean that believes itself to be pulling the waves up and crashing them on the shore. In reality, of course, while the ocean affects the motion of the oil, the oil has no influence over wave action. The influence is unidirectional only.

Epiphenomenalism suggests that mental events ride "above" the phenomena of the brain. The mind is like a layer of oil on the surface of the ocean that believes itself to be pulling the waves up and crashing them on the shore.

On the other hand, interactionist property dualism, or interactionism, envisions a two-way influence: mental events do have a causal influence on the brain and behavior, as well as vice versa. Psychological phenomena are an integrated but irreducible aspect of neurological functioning. As discussed below more fully, this dualistic perspective has a good deal in common with several of the positions presented as alternatives to dualism.

Materialism

The materialist position, that mental states are exclusively states of the brain, is perhaps the most common position held by philosophers and cognitive scientists today. There are a number of varieties of materialism or physicalism, however, each with distinctly different implications for the status of the mind and the field of cognitive psychology. Three of the more prominent materialist positions are type identity theory, eliminative materialism, and token identity theory.

Type identity theory was developed partly in response to new findings in neuroscience during the 1950s and '60s. This position proposes a one-to-one relationship between each mental event and a specific pattern of neurological firing. Mental states are, therefore, identical to the associated brain activity.

Eliminative materialists, on the contrary, argue that talk of mental states should be abandoned and replaced with references exclusively to brain states. Moreover, they propose that cognitive science should ultimately be abandoned in favor of neuroscience. Research in neuroscience does not support the one-to-one correlation that type identity theorists claim.

Finally, token identity theorists uphold the notion of mental events but reject the type identity theorists' assertion of a direct, one-to-one correlation between specific mental events and neurological events. This posi-

tion is most consistent with the field of cognitive psychology and has led to the philosophical position of functionalism. Functionalists hold that mental events can be examined independently of neuroscience and are classified in terms of their causal role.

Barbour begins his section on materialism by pointing to behaviorism as an example of materialism, an incorrect classification, I believe. Before explaining why behaviorism should not be categorized in this way, the distinction between psychological behaviorism and philosophical behaviorism should be pointed out. The first is an empirical research program that rejects appeals to mental events as explanations of behavior. By contrast, as philosopher William Bechtel explains, philosophical behaviorism

> is primarily concerned with the semantics of our common mentalistic vocabulary.... The goal is to translate terms that purport to refer to mental activity into terms that speak only of behaviors or propensities to behave in certain ways.[6]

Both psychological and philosophical behaviorism have their roots in logical positivism. Where the two differ, however, is the influence of Wittgenstein and Ryle on philosophical behaviorism. Ryle characterizes the mind/body problem as a "category mistake."[7] He gives the example of someone asking to see a university. After being shown through the buildings, walked around the grounds, introduced to the faculty and students, the person asks, "Now can you show me the university?" A category mistake is made by referring to the "university"—or in this case the mind—as an independent entity apart from its constituent elements. Bechtel explains Wittgenstein's view that philosophical problems, such as the mind/body problem, arise when language

> goes on holiday...[that is,] when we misuse ordinary language. And that the solution comes not in answering the problems philosophers pose but by dissolving the philosophical problems by appealing to how we ordinarily use the language.[8]

Philosophical behaviorism, therefore, is not an alternative to dualism or materialism, but seeks, rather, to eliminate the conundrum by showing it to be a linguistic problem. While most philosophical behaviorists are likely to be materialists, neither form of behaviorism is logically inconsistent with dualism. One could imagine that mental phenomena, although not an appropriate subject of study for social scientists, could ultimately be based in immaterial mind-stuff.

Two-Aspect Theory

Barbour identifies the two-aspect theory as the third of what he sees as the four main alternatives to the mind/body problem. This theory holds that some events have both a physical and a mental aspect. In reality, the two-aspect theory is but another version of property dualism. According to Bechtel, it is essentially epiphenomenalism. Barbour includes analyses of ordinary language in the category of two-aspect theory. However, ordinary language philosophy is part of the analytic tradition and is associated with Wittgenstein and philosophical behaviorism, among others.

Both the two-aspect theory and ordinary language philosophy are important elements in this discussion. However, they are distinct positions addressing different issues. The first asserts that minds have simultaneously both a physical and a mental aspect, similar to the wave-particle duality of quantum physics. Minds are real entities with real attributes that are the appropriate subject matter for the neurological and cognitive sciences. The second is linguistic theory, which focuses on how ordinary language is used, including the way in which mental events are classified. The first hypothesizes an entity with two distinct but real aspects. The other suggests one entity (with one "aspect"), which is referenced from different linguistic perspectives. Neither is a standalone theory. Two-aspect theory belongs to property dualism and ordinary language phi-

losophy is most closely related to philosophical behaviorism.

Multilevel Theories

Barbour seems to present a continuum of treatments, with dualism at one end and multilevel theories at the other. Interestingly, this continuum more closely resembles a circle in many respects, as multilevel theories come remarkably close to property dualism. Both positions hold that mental phenomena are causal and, as Barbour says of the multilevel view, "mental states and physical events are totally dissimilar kinds of things."[9] When discussing multilevel theories and Roger Sperry, one of its chief proponents, Barbour writes:

> [I]n all organisms there is a hierarchy of levels, with distinctive irreducible laws at higher levels. Emergent, holistic properties arise from organizational relationships and configurational patterns....[10]

Describing interactionist property dualism, Churchland writes:

> [M]ental properties are here said to be emergent properties, properties that do not appear at all until ordinary physical matter has managed to organize itself, through the evolutionary process, into a system of sufficient complexity.[11]

Even Descartes, the paradigmatic dualist, might have passed as a multilevel theorist when he repeatedly denied that the relation between mind and body is like that of a pilot to a ship. Consider the following passage from "The Principles of Philosophy":

> [T]here are...certain things which we experience in ourselves and which should be attributed neither to the mind nor body alone, but to the close and intimate union that exists between the body and mind....[12]

Conclusion

What, then, can be said about the mind and its relationship to the physical body? Can it be deconstructed—analyzed and classified? Or should one simply appreciate the mystery and complexity of the mind, as Camus suggested in the case of one's natural surroundings? In the end, both will be done, in all likelihood. As understanding of the brain and its processes increases, so too will the need to reconcile the often divergent views of cognitive science, philosophy and theology. Attempts to bridge these realms must begin with a thorough and accurate representation of a long tradition of theorizing in the philosophy of mind.

Far from being resolved, the mind/body problem remains one of the great mysteries of the day. That an independent mind is so central to the sense of self and yet remains so difficult to support scientifically suggests that there is need for ongoing debate, hypothesis testing, and cultural grappling with these issues. Because the notion of mind goes to the very core of what it means to be human, the implications of those discussions are profound.

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3. Barbour, ch. 10.
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5. Churchland, p. 10.
6. Bechtel, p. 89.
7. Ryle, p. 16.
8. Wittgenstein, *Philosophical Investigations*, as quoted in Bechtel., p. 27.
9. Barbour, p. 262.
10. Ibid.
11. Churchland, p. 12.
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Room for God?

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This essay begins with a review of several different approaches to the problem of divine action in the world, in light of the findings of science. Specifically, the speculation of Arthur Peacocke, John Polkinghorne and Nancey Murphy are elucidated and critiqued. Finding that Murphy, in founding her metaphysics on ontological reductionism, engenders theological reductionism, the author draws some conclusions are as to elements of a theologically attractive position.

Science, in restricting its interest to the empirically testable public domain, can function without metaphysics. Science has no need of God. Theology posits a God who acts in the world, whose reality science purports to describe. And so, in a dialogue between science and theology, the burden of explanation rests on theology when addressing the question, How does God act in our world?

Nancey Murphy accepts this burden, in her essay entitled, "Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat." However, rather than dialogue with science, she embarks on an adoption of science. And in assuming the reality of physics, she limits the reality of God. In founding her metaphysics on ontological reductionism, she engenders theological reductionism. Her argument is fraught with ambiguities, contradictions, theological conveniences and less-than-inspiring concepts of God. But worse, from the point of view here taken, her argument undermines both divine and human agency.

My approach will be first to address the fundamental change in science that has given rise to new possibilities for speculation on divine activity. I will then elucidate and critique the speculations of both Arthur Peacocke and John Polkinghorne concerning divine action. After addressing Murphy's critique of each, I will then critique Murphy's thesis. At each stage, consideration will be given to the effects on the concept of God of speculation. Finally, I wish to consider a more fruitful ground for dialogue between science and theology.

In classical physics, every event had a physical cause. God was the primary cause, and all else happened by means of secondary causes. Newtonian physics "led to a view of the world as mechanical, deterministic and predictable."[1] And while Newton still allowed for God to be active in this machine-like, post-creation universe, deism arose as the prime theology of science. God set the universe in motion and then retired from it. It was then but a short step to the total elimination of God from the scientific picture of a causally determined universe. With the dawning of quantum physics and chaos theory, this picture has changed.

As astrophysicist William Stoeger explains, quantum theory posits that

> at [sub]microscopic levels there is an irreducible indeterminism, represented both by the Heisenberg uncertainty principle and the unlocalizability of unmeasured particle-waves.[2]

For quantum theorists, indeterminism at the sub-atomic level is an ontological reality.

Chaos theory posits the reality of "chaotic dynamic systems."[3] These systems have an underlying determinism. That is, "their future states are, in principle, entirely determined by their present state and the forces acting on them."[4] However, it is impossible to "specify their initial states with infinite precision...[as they] eventually lose the ability to predict [future] behaviour."[5] For chaos theorists, unpredictability in chaotic systems is an epistemological reality.

It is in chaos theory that Polkinghorne grounds his metaphysics of divine agency. "The exquisite sensitivity of chaotic systems...means that they are intrinsically unpredictable and un-isolable in character."[6] Polkinghorne posits that while bottom-up causality sets the whole system in motion, as it where, the "patterns of possibility are brought about by sensitive responses to infinitesimal disturbances of the system."[7]

Being a critical realist, Polkinghorne walks quickly from his base in epistemological unpredictability to stand in ontological indeterminism. "These epistemological properties signal that ontologically much of the physical world is open and integrated in character."[8] Because much change, through the amplification effect, can happen after the initial bottom-up causality, "there is scope for the activity of further causal principles."[9] There is room for God.

Polkinghorne sees God's agency as having an "holistic top-down character...concerned with the formation of dynamic pattern, rather than with transactions of energy."[10] God's agency is by way of "active information."[11] God provides the context within which "the behaviour of the parts [is] influenced by their overall context."[12] While bottom-up causality is a transfer of energy, top-down causality is a transfer of information within an holistic context. "'Clockwork' systems, insensitive to the details of circumstance...[remain] unmodified"[13] while the whole is free to respond to God.

Polkinghorne further speculates concerning the essence of complementarity. As the "apparently qualitatively different characters of wave and particle [are] present in a single entity, light... [and as] the apparently qualitatively different realms of the material and the mental" are present in each person, so chaotic systems are "influenced by both energetic transactions and by active information."[14] Dual-action monism makes room for God.

While Polkinghorne's proposal gives primacy to the harbor of science while practicing docking procedures for theology, his metaphysics is satisfying on several counts.

While Polkinghorne's proposal gives primacy to the harbor of science while practicing docking procedures for theology, his metaphysics is satisfying on several counts. It respects the findings of science, entering into an open dialogue of possibility. It respects theology. The mystery and open agency of God are preserved. God is not seen as "interact[ing] with the world by the careful calculated adjustment of the infinitesimal details of initial conditions."[15] God is not a cosmic mechanic. The human experience of agency is preserved. Persons of faith experience themselves as responding to the context of God. And this free response to circumstance is not undermined at the subatomic level. The possibility of

fundamental agency is not deleted from this metaphysics.

Nor does Polkinghorne, furthermore, claim to have all the answers. He allows that while dual-aspect monism is a useful concept, "consciousness is a much more profound and mysterious property than history formation by active information."[16] Like the chaos theory he invokes, Polkinghorne's metaphysics—indeed Polkinghorne's God, for whom the "future is still inherently unknowable,"[17]—remains refreshingly open to new possibilities.

Peacocke is also open to science, but his account of divine action differs from Polkinghorne's in two important respects. In the first place, while accepting the unpredictability of chaos theory, he does not move from this epistemological unpredictability to ontological indeterminacy. Secondly, while positing top-down causality as the mode of God's interaction with the world, Peacocke does not ground this possibility in the unpredictability of bottom-up causality. In common with Polkinghorne, Peacocke envisions God's influence on the world as being in the nature of information, not energy.

For Peacocke, chaos theory, with its unpredictable variables, makes probable "a looser form of causal coupling at [the] micro-level than had been taken for granted in classical, deterministic (Laplacian) causality."[18] Causality is not eliminated; only classical, deterministic causality. Through amplifications of fluctuations since the initial conditions, new patterns emerge at the macro-level. The dynamic systems of chaos theory are non-linear. Rather they are organic, self-organizing systems. "Through the amplification of small fluctuations," he writes, nature "can provide natural systems with access to novelty."[19]

Another important feature to note is that the whole is greater than the sum of its parts. The whole bestows new boundary conditions on the parts, and in this new situation they behave differently. Peacocke calls this behavior "whole-part constraint."[20] Further, the whole is to be understood as comprising complex levels of hierarchy. And none can be reduced to the features of the others. There are emergent realities at higher levels of complexity. The system as a whole interacts with the parts and with other systems. It is within this concept of the whole that God must act.

And there is room for God, not as for Polkinghorne in an ontological gap at the fundamental level of reality, but at a supervenient level of a totality that is flexible and open-ended.[21] God can exercise constraints without upsetting the laws of nature, without intervening. Peacocke provides an human analogy for God's agency in our world.

> Holistic states of the brain-as-a-whole...could legitimately be referred to in non-reductionist mentalist language as a real modality of the total unitive event which is the activity of thinking that is accomplished by the human-brain-in-the-human-body.[22]

By analogy God "exerts constraints upon the world-as-a-whole."[23] Peacocke calls God's interaction through a flow of information, communication.

Peacocke maintains God's otherness: God is ontologically different from the world, yet both transcendent and immanent. For Peacocke, God is the "continuing supra-personal, unifying Agent acting, often selectively, upon all-that-is, as God's own self purposes."[24] As with Polkinghorne, Peacocke's metaphysics tacks theology onto science. And again, as with Polkinghorne, Peacocke's metaphysics is satisfying on several counts. Top-down causality fits well with our experience of ourselves and our world. The mystery of God and both divine and human agency are preserved. Divine agency of this sort leaves room for individual response within the constraints of the whole.

Less satisfying is the fact that both Polkinghorne and Peacocke give primacy to science and try to fit God into a scientific gap, ontological or otherwise. However, their metaphysical proposals do seem to encourage an expanded concept of God. And most importantly, they feed the imagination

as it ponders the awesomeness of creation at both the micro and macro levels and the wonder of our God, who wants to interact and create with us.

In contrast, and with all due respect, Murphy's metaphysics ultimately constricts the concept of God and boggles rather than feeds the imagination. She accepts the possibilities for divine action that follow from Peacocke's account of top-down causation. She accepts it, because it "explains how human free agency is possible within a highly deterministic universe."[25] However, she finds his analogy from human to divine agency, from human-brain-to-human-body to God's agency on the world-as-a-whole, to be unhelpful. Murphy rejects this analogy for two reasons. Since God has no body, the analogy does not elucidate the manner of God's agency in the world. It is hard to see her logic here, since surely the analogy was meant to illuminate God as mind, transmitting information, and the world as the entity, or body, toward which and within which God acts. Her second objection protects the ontological otherness of God.

> [I]f we understand mental events as a function of the operation of the organism at a high level of organization, we...have trouble applying the account to God [because] God would then be the world-mind or the world-soul.[26]

Murphy's theology cannot accommodate this possibility.

Her ultimate rejection of top-down causation as a sufficient explanation for divine activity in our world rests on her observation that "the effect of the environment is always mediated by specific changes in the entity itself."[27] The entity must already be fitted for, as it were, and respond to the environmental factors that impinge upon it. And so, in the same way, "top-down causation by God should be also expected to be mediated by specific changes in the affected entities."[28] And so, she sees the need to "supplement...Peacocke's top-down approach" with a bottom-up account of God's causal input.[29]

Murphy posits that the unpredictability inherent in chaos theory gives God, not ontological room in an otherwise causally determined order, but epistemological room within which God can work without upsetting the perception of law-like natural order

However, ostensibly, she does not accept Polkinghorne's account of bottom-up causality. While she affirms that the unpredictability inherent in chaos theory is extremely important for an account of divine action, she is quite right in not allowing Polkinghorne the critical realist's leap from epistemological unpredictability to ontological openness. Polkinghorne's metaphysics (unlike Peacocke's) depends on ontological openness for its top-down account of divine agency.

Her critique of Polkinghorne's leap aside, Murphy challenges his vagueness concerning the manner of God's agency in the world. In a rather vague critique, she asks to whom and how non-energetic information might be contributed.[30] And, ignoring the "holistic" top-down character of divine action, and also the theological possibility of co-creation through double agency, she worries that God is reduced to "acting as an agent among other agents."[31]

In Murphy's own metaphysical proposal, she considers herself as allowing both chaos theory and top-down causation "a subsidiary role."[32] She posits that the unpredictability inherent in chaos theory gives

God, not ontological room in an otherwise causally determined order, but epistemological room within which God can work without upsetting the perception of law-like natural order.[33] In other words—and presenting rather odd theology, since the amplification of fluctuations following initial conditions renders subsequent macro outcomes unpredictable to us—God, who "prefers to work on our behalf 'under the cover of chaos,'" has lots of room to act in the world without us noticing.[34]

She affords top-down causality a subsidiary role for two reasons. Firstly, in her metaphysics she gives primacy and supremacy in creation to humans, positing humans as one of only two avenues for divine action in the world. With this position, she needs top-down causality in order to posit "God's top-down influence on the created order through human top-down agency."[35] Secondly, since her metaphysics posits God's respect of the integrity of each created entity, she must acknowledge that "the inherent powers of an entity in isolation will not tell us what it can do when incorporated into a higher regime."[36] The whole affects the parts. Nevertheless, it is to the parts, to the "mediated causality" of the whole, that Murphy turns in her account of divine agency. While she bases her metaphysics on "ontological reductionism,"[37] she claims that her metaphysical proposal is not "based on the particularities of quantum theory."[38] However, this claim stands on shaky ground.

Having granted subatomic entities "existence independent of God,"[39] Murphy, in keeping with chaos theory, allows that it is impossible to "predict exactly when they will do whatever they do."[40] This is a claim of epistemological unpredictability. But then, in a leap of the sort she disallows Polkinghorne, she assumes that they never have "sufficient reason" ever to do anything. Surely, this is an ontological claim. It is a claim about what is the case. Perhaps in quantum theory it might be justified to speculate as to insufficient reason, and Murphy does this. "[Q]uantum events do not obey deterministic laws [and] [i]ndividual events violate the principle of sufficient reason...."[41] But given the underlying predictability of chaos theory, there is no necessity to posit insufficient reason. In doing so, Murphy has moved from the realm of epistemology in chaos theory to the realm of the ontological indeterminacy of quantum theory.

Murphy argues that God's governance is not dominance but co-operation. However, if, as she says, God makes all the decisions at this level, it is hard to see how this could be construed as co-operation. God's action smacks of control.

Having assumed no "sufficient reason," external or internal, for any subatomic entity to act, Murphy presents the false dichotomy of "complete randomness or divine determination." Any notion of choice that might have been extracted from the analogy of the Buridian ass is nixed. Murphy's subatomic particles are allowed no choice, no chance to respond to each other or to the environment. Nor can they remain passive and be moved by an environment, like a leaf in the wind. Complete randomness is rejected simply because it is counter-intuitive.

Since it is hard to see how the epistemological unpredictability of chaos theory, with its underlying determinism, is counter-intuitive, it can only be assumed that Murphy is, once again, making an ontological claim of indeterminacy. It would seem, then, that, notwithstanding her claim to the contrary, Murphy's metaphysics is dependent on the

particularities of quantum theory. At the indeterminate level of quantum theory, she finds an ontological gap for God.[42] And, not seeing that she has made any ontological claims at all, Murphy leaps back into epistemological unpredictability by declaring God to be a kind of "hidden variable" in chaotic determinism.

Although Murphy would not agree, it appears that on the one hand God enters the ontological gap postulated in quantum indeterminacy, and on the other hand God accounts for the lack of a fundamental gap in the epistemological unpredictability of chaos theory. Murphy's metaphysics has one foot in quantum theory and one foot in chaos theory.

Instead of rejoicing at the first-ever admission by the scientific community that the universe is not a closed causal system, instead of envisioning new possibilities for co-creation and new possibilities for theology, instead of enlarging our concept of God, Murphy insists, on "a strong measure of divine determinism at the most basic level of natural processes."[43] She reduces God to fit a scientific gap. And, ironically, her reason for doing so is theological:

> By taking quantum events as the primary locus for divine action it will be possible to meet many of the theological needs placed upon my theory.[44]

In traditional theology God provides "sustenance, governance and co-operation."[45] As well, God is consistent and non-coercive. Murphy cites Jesus as the model of the non-coercive nature of God. In her metaphysics, Murphy "claim[s] that the relevant feature of God's action in Christ, displayed analogously throughout the whole, is its non-coercive character."[46]

Regarding God's character and agency at the quantum level, Murphy's metaphysics says that God has created each individual entity at that level. Created entities are ontologically other than God; they have their own being and integrity. Each entity has the *potential* to function in the capacity for which God created it; however, one must stop short of saying that each subatomic entity has the *ability* to function in the capacity for which God created it. No entity can act without God's action. God is the "necessary but not sufficient condition"[47] for all action at this quantum level.[48]

> God's governance at the quantum level consists in activation or actualizing one or another of the quantum entity's innate powers at particular instants, and these events are not possible without God's action.[49]

What is Murphy saying? She is saying that in the created world, fundamental, intrinsic agency is out of the question. Granted, she is considering the subatomic quantum level; but an important principle is at stake. Even given an innate capacity to act, an entity is impotent if unable to do so. If the understanding is that God acts at this level to sustain the entity in both its physical integrity and its action, then agency is not lost. But Murphy says more than this. God decides "when" the entity will act. Surely agency involves deciding when. Surely an entity's "natural right," which Murphy says God respects, includes the right to decide. An innate capacity to swing one's arm even as one is created and sustained by God does not constitute agency. The intention and decision to extend it to one's neighbor does. In Murphy's metaphysics, God is the sole agent at the quantum level.

This proposition has implications for agency at higher levels, including human agency, especially as

> the attempt to find indeterminacy between the quantum and human level is unnecessary if we have already made allowance for God's action at the most basic levels of organization.... [50]

Murphy admits that

> macroscopic objects are *composed* of the entities of atomic and subatomic physics. This being the case, much (but not all) of the behavior of macro-level objects is determined by the behavior of their smallest constituents.[51]

And the behavior of these smallest constituents appears to be controlled by God.

Murphy argues that God's governance is not dominance, but co-operation. However, if, as she says, God makes all the decisions at this level, it is hard to see how this could be construed as cooperation. If God decides "when" an entity will act, God's action is more than sustenance and less than co-operation. God's action smacks of control. God "act[s] upon..." [52] entities. Further, Murphy writes with approval that God does not compete with entities; but clearly this is because there is no contest. And as for God being non-coercive, her analogy with Jesus breaks down. Jesus allows the blind man to come to him and asks the blind man what he wants. Jesus does not just act on his behalf. There is no inkling from Murphy that the subatomic entities have any input regarding their "intentions." God's intention is the sole determining factor.[53]

Regarding God's intentionality, Murphy is somewhat ambiguous. The statement, "all events are manifestations of divine will," [54] seems straightforward. However, less so is the statement that while "all events are the result of God's causal influence; only some events express (to us) God's intentions." [55] Thus far, given the caveat "to us," it can still be maintained that all events constitute God's intentions, God's divine will. However, Murphy adds, "[i]t is the latter that ought, strictly speaking, to be called God's actions." [56] This assumption must be challenged.

To begin with, is not causal influence God's action? If not, then God's agency is undermined. But most importantly, given theology's assertion that for God there is no gap between God's will and God's action, one must ask, Are not all God's actions God's intentions? And are not all God's intentions God's actions? Again, if not, then God's agency (and ontology) is undermined. Further, not only does Murphy's definition of God's action assume superior status for humans in the created order, but it conjures up images of a God who operates on automatic pilot, when not specifically communicating intentions to humans.

And here is the crux of the matter concerning the theological reductionism inherent in Murphy's metaphysics: In forcing God into a subatomic gap, the very concept of God is reduced. As evidence, the terms speak for themselves. God "engineers" desired outcomes.[57] God works through subatomic "manipulations." [58] God tampers with initial conditions at the quantum level.[59] At the human level, God "stimulates neurons...[to] cause thoughts to be recalled to mind." [60] Even if God does these things to "bring about extraordinary events," [61] these are not satisfactory theological concepts!

A God who engineers, manipulates, tampers and messes around in the brain[62] does not fit with the God revealed in Christ. Granted, dreams and wakeful associations can be of God, but top-down causality would account for these in a way more consonant with experience both of God and of humans. In any case, by the time this part of Murphy's proposal is reached, the concept of God as some tiny, meddlesome being is too strong to erase. The damage of theological reductionism is done. A satisfactory metaphysics must expand, not limit, the concept of God.

Perhaps, just as science cannot account for consciousness, science should not be expected to account for divine agency. It seems impossible and theologically self-defeating to try to transfuse science with purpose. God and humans are intrinsically purposeful; science is not.

Another, different sort of theological reductionism is Murphy's use of God as a convenience when her scientific argument thins. For instance, "natural processes look so much like...determinate forces," because, basically, God wants it that way. "[O]ne of God's chief purposes is (must have been) to produce...an orderly system."[63] It does no service to theology to inject God into an argument in this way.

However, the main manifestation of theological reductionism—a reductionism that would require of Christians in some traditions too high a price—is the loss of the essence of the Trinitarian God as relational. God is a relational God in both the realm of *theologia* and *economia*. Relationship presumes free agency and free response.[64] There remains the awful suspicion, in reading Murphy's account of divine agency, that human agency is undermined at the quantum level. Is not governance a rather outmoded concept? Control is in the air, rather than sustenance and co-operation. Murphy misses the relational essence of her argument for mediated causality.

She rightly posits that

> team spirit only affects an individual insofar as sights and sounds emanating from the other people affect the individual's sensory organs.[65]

What she misses is that this is a relational analogy, involving free response to free environmental input. There is no sense that God is manipulating the individual in any way. Individual persons register the environmental action toward, not upon, them and respond. They are free to act in participating in the activities of the team. Jesus so affected his disciples that they freely decided to follow him in God's work. If, in one's theology, God rejoices in such freedom and such response, and if it is to this kind of God that we can respond, then Murphy's theology falls short.

Polkinghorne, in the context of the increasingly holistic outlook of science, writes that it is

> clearly worthwhile to pursue the program of reductionist explanation as far as it can legitimately be pursued, but that is a methodological strategy for investigation, not a metaphysical strategy determining the total nature of reality.[66]

In the context of both science and theology, it is Murphy's move, from a methodological strategy of ontological reductionism to a metaphysical strategy determining divine agency, that results in theological reductionism.

Perhaps, just as science cannot account for consciousness, science should not be expected to account for divine agency. It seems impossible and theologically self-defeating to try to transfuse science with purpose. God and humans are intrinsically purposeful; science is not.

Instead of trying to make theology fit science it might be better to start with an assumption of God's presence as the environment in which we have our being. In this context, the data of theology can be considered—namely, human experience and actions. Murphy alludes to these data but does not engage them. In the context of top-down causality she writes,

> natural beings and processes operate somewhat differently in the presence of people imbued with the presence of God.[67]

Does faith in God impart a new boundary condition in which the individual has the potential and freedom to respond and be transformed? While top-down causation would best account for such a reality, it is possible that no amount of scientific exploration will ever enable us fully to understand the glorious mystery of our God, ourselves, and our world. This does not preclude a dialogue between science and theology. If theology does not try to "fit God into" science, and if science does not try to "shut God out," then science and theology can talk to each other. In such a climate for dialogue, there is hope that the awesome discoveries of science might fire the theological imagination and expand and illuminate the concept of

God. There is room for science. And furthermore, in such a climate, there is hope that the developments of quantum physics and dialogue with theology might open the scientific mind to the possibility that what science describes is not necessarily the way things are. There is room for God.

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Peacocke, Arthur R. "God's Interaction with the World." In *Chaos and Complexity*, 266-287. See Murphy.

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Endnotes:

1. Peacocke, p. 265.
2. Stoeger, p. 185.
3. Russell, p. 14.
4. Ibid.
5. Ibid.
6. Polkinghorne, p. 153.
7. Ibid.
8. Ibid.
9. Ibid.
10. Ibid., p. 154.
11. Ibid.
12. Ibid.
13. Ibid.

14. Ibid., p. 155.

15. Ibid.

16. Ibid.

17. Ibid., p. 156.

18. Peacocke, p. 266.

19. Ibid., p. 270.

20. Ibid., p. 273.

21. Ibid., p. 283.

22. Ibid., p. 284.

23. Ibid., p. 283. Systematic theology speaks of "thinking God." It is interesting to see the possibility in Peacocke's metaphysics that God "thinks us."

24. Ibid., p. 286.

25. Murphy, p. 339.

26. Ibid.

27. Ibid.

28. Ibid.

29. Ibid.

30. Ibid., p. 328.

31. Ibid.

32. Ibid., pp. 348-9.

33. It is beyond the scope of this paper to address Murphy's proposal that the "laws of nature" should be de-ontologized. However, this would be an interesting idea to pursue.

34. This brings to mind Descartes' early question, "Is God a deceiver?"

35. Ibid., p. 349.

36. Ibid.

37. Ibid., p. 354.

38. Ibid.

39. Ibid., p. 341.

40. Ibid., p. 342.

41. Ibid., p. 338.

42. Murphy doesn't find the gap in the openness born of the amplification of fluctuations post-initial conditions to be in the "range of possible outcomes," a finding that might redeem her metaphysics somewhat; she finds the gap in the very initial conditions themselves. God is the fundamental and only cause of any action. Agency is preempted.

43. Ibid., p. 344.

44. Ibid.

45. Ibid., p. 330.

46. Ibid.

47. Ibid., p. 343.

48. While Murphy sees Polkinghorne's account of the manner of God's agency as vague, Murphy's is equally so. She seems to use the quantum ontological gap as a causal joint for God's agency. However, she does not address the issue of how an ontologically other God acts at the subatomic level. Is it an energy transfer? It cannot be informational influence, because her quantum entities are not free to respond to their environment.

49. Ibid., p. 342.

50. Ibid., p. 327.

51. Ibid., p. 342.

52. Ibid.

53. If Murphy was seeking a way to account for the law-like nature of our world, then positing God's intentionality would seem more palatable. (Granted, she does make this move with her concept of epistemological room for God—that is, of God never changing things so much that we lose our sense of order in the world.) But here she is positing God's controlling intentionality at the quantum level, the very level at which science is recently open.

54. Ibid., p. 355.

55. Ibid., p. 352. Murphy's use of the word "influence" undermines her thesis, since the subatomic entities are not free to respond. God decides when they will act. This is more than influence. Here, it seems that Murphy thwarts her intention to avoid occasionalism, whether in its technical or ordinary usage. She does not want to say that "each sub-atomic event is solely an act of God [since this] would be

a version of occasionalism." And yet quantum entities cannot act until God decides when they will act. It could be argued that since God is the necessary but never sufficient cause, God is not the sole agent. This is a moot point, since the quantum entities, without God, have no sufficient cause to act. As well, if God acted only when conveying God's intentions to humans, then God would act only occasionally.

56. Ibid., p. 352.

57. Ibid., p. 350

58. Ibid., p. 329.

59. Ibid., p. 347.

60. Ibid., p. 349.

61. Ibid., p. 347.

62. Here, for Murphy, there is a price to pay. Against her wish, this seem to exacerbate the problem of evil. As some people have put it, if God acts directly on the neurons of our brains in order to make us think a certain way, then why, if God could, did God not intervene when Hitler was abusing his agency in the world?

63. Ibid., p. 346. Here Murphy seems to undermine her own theory that natural processes only seem law-like to us; they are not ontologically law-bound.

64. For both God and humans. God changes God's mind in response to Abraham. Jesus changes his mind in response to the Syrophoenician woman. Both God and humans are free to change and grow.

65. Ibid., p. 339.

66. Polkinghorne, p. 150.

67. Murphy, p. 349. Some theologians say that the presence of God is a very different and much richer ground for exploration than the God presented at the level of quantum entities.

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In analyzing the dialogue between science and religion, the author finds that it is hampered by three semantic problems. The first denies, or at least undervalues, the two modes of knowing most apropos to religion: the emotional and the intuitive/mystical modes. Secondly, the uncritical use of language causes considerable confusion. The third problem limits discussion to what Stephan Schwartz has called the "Grand Material Paradigm." As the conclusion of the essay, a précis of an alternate cosmology is presented.

Introduction

The latter days of the twentieth century could be a particularly productive time to examine the relationships of science and religion. Most of our present scientific knowledge was unknown a mere century ago. And in the world of religion, the unprecedented globalization of religious dialogue offers great opportunities to expand understandings of one's own religion as a result of familiarization with others. However, in engaging in discussions between science and religion, especial effort must be devoted to avoid, insofar as possible, the error of parochialism. Unfortunate examples of this error include what I shall call the "epistemological problem," the "language problem," and the "paradigm problem." I shall begin by examining examples of these semantic problems in the writings of respected scientists and theologians, then conclude with an example of an alternative cosmology that, while consistent with both experiential theology and modern science, is not even considered in "mainstream" religio-scientific thought because it is excluded by the pervasiveness of the three errors mentioned.

First, a definition of terms is in order. Concerning science, Bertrand Russell states:

> Science, as its name implies, is primarily knowledge; by convention it is knowledge of a certain kind, namely which seeks general laws concerning a number of particular facts. Gradually, however, the aspect of science as knowledge is being thrust into the background by the aspect of science as the power of manipulating nature.[1]

It seems clear, furthermore, that Russell considers this latter aspect of science correlative to the technique of science. Science, then, may be identified as (a) knowledge, (b) the technique of obtaining that knowledge, and (c) the method of organizing the knowledge. None of these components alone is science; rather, taken together they constitute science.

Religion is more difficult to define adequately. In ordinary conversation religion may be taken to mean either an intellectual belief system, a code of rules and rituals, or a way of life. In some Indonesian cultures, there is no word that will adequately translate religion. The closest one can come to asking "What is your religion?" is, "What is your ritual way?"[2] I suggest that, at least for adherents to the monotheistic religions, religion is much more than a "ritual way": it is first a way of making emotional sense

of one's personal universe, secondly, a resultant way of life, and thirdly, a set of intellectual beliefs that undergird the two primary functions.[3] The code of rules and rituals is ultimately a subsidiary convenience intended to assist in living the chosen way. That this is so is attested by the fact that the majority of adherents to the monotheistic religions consider a rule-bound fundamentalism to be an aberration.

The epistemological problem

Science as a technique demands objective knowledge. Properly understood, this demand both broadens the application of scientific knowledge and limits its scope. Human beings have three primary ways of knowing: sensory/rational, emotional,[4] and intuitive/mystical. The epistemological problem is simply valuing the first way of knowing to the exclusion of the latter two, which deeply inform religious experience. Certainly sensory/rational knowledge has a higher objective content and is, therefore, more productive for most scientific studies. But in the terrain of the religious, one is no longer on primarily objective ground, and emotional and intuitive/mystical knowledge are ignored at the risk of throwing out the baby and keeping the bathwater.

The essential centrality of subjective experience is indicated by the following story:

> One summer evening Art was watching TV while his children played in the front yard. Suddenly his attention was captured by the screech of brakes. As he bounded to the door, his mind was already filling with pictures of a bleeding child having been struck by a car. But when he opened the door, he saw both children happily playing marbles. The car had driven on down the street, with no obvious reason for its abrupt stop. As Art returned to his TV show, his heart was still racing, his hands and feet were cold, his stomach was knotted, and the metallic taste of fear filled his mouth. Yet there was no objective reason for these symptoms. He had created a terrifying scenario from the force of his own fear, and was bearing the physical consequences of this very real manifestation of his fear. Had he had a weak heart, his fear might even have killed him.... we live in subjectivity. If I feel strong, relaxed, and confident, my cardiovascular system and my immune system will perform at full capacity. If I feel weak and sick, I will act sick and weak. If I feel afraid, my physiological responses will reflect that fear. My belief, whether positive (faith) or negative (fear), will give substance to my expectations.[5]

Since we live in subjectivity, any dialogue between science and religion must deal with subjective knowledge. Specifically, most of what would generally be considered to be religious in the life of an adherent to any of the monotheistic religions has significant components of emotional and intuitive/mystical knowledge. It is not surprising that science should, in the name of objectivity, give little time to these forms of knowledge. But theologians, possibly in their drive to be recognized by scientists as "real scholars," have neglected them to an equal extent. This dehumanizing of theology has been well-expressed in the quip, "God sent the Christ and the Word became flesh. Then theologians appeared and it became words again."

Ian Barbour attempts to include the emotional component under the term *numinous*, which he defines as "a sense of awe and reverence, mystery and wonder, holiness and sacredness."[6] I would suggest that this usage is too limited to cover the whole of the emotional component of religious experience. We sense a transcendence approaching the numinous when we participate in a wedding or funeral, but we may also experience the elation of *koinoneia* (fellowship) during praise and worship. When engaged in service to others, we may experience a sense of satisfaction made all the more intense by our understanding that such service is more than mere altruism: it is religious privilege and duty.[7] This primary emotional content of the religious experience has been treated extensively by William James.[8] In contrast, Barbour,

Karen Armstrong, and Paul Davies give emotion short shrift. In so doing, they are in the company of most academic (as opposed to what might be called "practical") theologians.

Mystical or intuitively derived knowledge has recently become "acceptable." This development is in part caused by the Western "discovery" of Eastern religions in the past half-century (although Madame Blavatsky's and Annie Besant's work during the latter part of the nineteenth century is not to be discounted in its effects along those same lines). Its newly accorded acceptability derives also in part from the capability to test some intuitive knowledge objectively. However, very little of this knowledge is admitted to the hallowed halls of either scientific or theological inquiry. Studies of such notable intuitives as Edgar Cayce, Eileen Garrett, G. I. Gudjieff, Olga Worrell, Rudolph Steiner, and Meister Eckhart are viewed askance by both mainstream science and theology. Cayce,[9] Steiner,[10] and Gurdjieff,[11] working quite independently, offered intuitively derived cosmologies with impressive internal consistency, and with considerable mutual consistency. Yet their views are not given even the courtesy of an attempted refutation.

Human beings have three primary ways of knowing: sensory/rational, emotional, and intuitive/mystical. The epistemological problem is simply valuing the first way of knowing to the exclusion of the latter two, which deeply inform religious experience.

The traditional name used in the Jewish-Christian-Islamic tradition for intuitive inspiration is prophecy. The word comes from the Greek προφητεια, which means "ability to declare the divine will."[12] (Note the contrast to Armstrong's definition, "standing in God's presence."[13]) Armstrong dismisses any possibility of true prophecy out of hand; she considers it an attribution of human feelings and experiences.[14]

Contemplatively derived knowledge differs in content rather than in origin from intuitive knowledge; both fall within the category of mystical. The former is normally taken to concern direct and immediate perception of Being, or God, or All-that-is. Barbour,[15] Armstrong,[16] and Davies[17] have all read of mysticism and hold it in some esteem; but none of them gives evidence of having experienced it. While the content of intuitive statements, e.g., prophecy, is often susceptible to objective verification,[18] the experience of mystical union with the transcendent can only be verified directly by other contemplatives.[19]

Mystical/intuitive/contemplative knowledge has been a part of all known cultures as far back as records exist. In the sixth century B.C.E., Lao Tse said:

> Without going outside
> you may know the whole world.
> Without looking through the window,
> you may see the ways of heaven.[20]

Jewish mysticism is evident throughout the Hebrew scriptures, as far back as the book of Job, the original form of which is considered by some scholars to be the oldest text in the canon. The mystical tradition can be traced historically at least from the "school of the prophets," of which King Saul was arguably one, through Elijah and to the Essenes of Jesus's time, who claimed a direct organizational descent from that school. Mysticism is also central, or near-central, in Buddhism, Taoism, Zoroastrianism, Christianity, and some variants of Islam. A serious attempt to understand it can be made from studying the later papers of Carl Jung, and

such effort is essential to any relevant study of the religions of humankind.

The language problem

The language problem consists in unacknowledged differences in usage of key words from one writer to another. Often it results from a given writer's not being familiar with the nuances of meaning of a particular word or, alternatively, attaching additional connotations that are not properly a part of the strict denotation of a word. One instance of the language problem is found in the introduction above, where the difficulty is noted of translating the term *religion* into some languages. Other examples include the persistently pejorative references to any belief in an independently existing spirit as necessarily dualistic. Barbour assumes that spirit must be absolutely distinct from body— if spirit exists at all—whereas the mystical understanding is that spirit animates body in this as well as other dimensional realities.[21] The computer in my car is undeniably one with the car, yet they can exist independently. In fact, the computer could function on a test bench without the car, although the car cannot function without the computer or something very like it. When I look at the car, I don't see the computer, even if I look under the hood. In fact, trained mechanics transported to the present time from the 1960s would not be able to comprehend the computer at all, even if they saw it. Yet no one considers our understanding of the computer/car relationship to be dualistic.

A closely related difficulty is the separation of the generic concept of spirit from the specifically Greek concept of spirit. The Greek position, adopted by some of the Gnostic Christian groups, was that the spirit is completely good or incorruptible, and matter is completely evil. Belief in the reality of a "spiritual dimension" entails no necessary connection with the concept of spirit as incorruptible.

A final example emphasizes the need to transmit technical usages faithfully when quoting another author. William James discusses the religion needed by "the sick soul."[22] However, he uses "sick" to indicate a certain kind of habitual temperament, not a distemper. When quoting his work, Armstrong does not make this distinction clear.[23]

The paradigm problem

With his publication of *The Structure of Scientific Revolutions*,[24] Thomas Kuhn made a vitally important contribution to the understanding of human nature in particular and of science in general. His concept of paradigms has passed sufficiently into the public consciousness to need no elaboration here. Kuhn points out that it is the nature of "normal science" to oppose Copernican leaps. Rather, "normal science" requires both problems and solutions to fit within the current paradigm.

While, as Kuhn points out, paradigms are essential for normal science to proceed, outdated paradigms limit the fruitfulness of dialogue between science and religion.

Stephen Schwartz, former Special Assistant for Research and Analysis to the Chief of Naval Operations, has extended Kuhn's analysis to include a metaparadigm that ties together all sciences. He enumerates the assumptions held under this Grand Material Metaparadigm as follows:[25]

(1) The mind is the result of physiological processes governed by bioelectrical postulates.

(2) Each consciousness is a discrete entity.
(3) Organic evolution moves toward no specific goal but simply flows according to Darwinian survivalism.
(4) There is only one space-time continuum and it provides for only one reality.

Schwartz published this analysis in 1978. Today, these assumptions might be modified slightly to include biosociological postulates under item (1),[26] and item (4) might be deleted completely. However, research questions involving mind existing independently of a physical body, or questions speculating about any nonphysical reality, are certainly not permissible under the current paradigm. However, it is just such questions with which religion deals. As a result, the sort of dialogue engaged by mainstream theologians and scientists is bound to strain normal understandings of the participant who feels him- or herself to be in the weaker position—i.e., the one whose position is less well-centered in the paradigm. Today, this participant is the one representing religion. Thus we have the untenable cases of theologians who do not believe in *Theos*, "Christians" who do not believe in even the possibility of resurrection or life after physical death, etc. Orwellian New Think is indeed upon us.

Examples of paradigm-breaking research abound. Targ and Puthoff's remarkably successful work with remote viewing (later extended under contract with the Pentagon) strongly suggest that clairvoyance and telepathy are normal, if undeveloped, human abilities.[27] Larry Dossey's summary studies of whether prayer is efficacious in physical healing yielded an undeniable affirmative.[28] Backster's work on human-plant communication implies a sort of consciousness in plants that responds to human intentionality.[29] Ingo Swann was able to influence the behavior of a niobium-superconductor-shielded superconducting quantum interference (SQUID) magnetometer remotely.[30] Ian Stevenson, Carlson Professor of Psychiatry and Director of the Division of Personality Studies at the Health Sciences Center, University of Virginia, has convincingly argued for individual survival of physical death through the mechanism of reincarnation.[31] Each of these phenomena has been researched carefully by qualified scientists. Some of the research has been conducted under the auspices of such respected institutions as the Stanford Research Institute and the Engineering Anomalies Laboratory at Princeton University (PEAR). However, even though physicist William Tiller,[32] aerospace scientist Robert G. Jahn, and PEAR manager Brenda Dunne[33] have offered models designed to begin the process of explaining these remarkable observations, neither the observations nor any hypothetical explanations have been incorporated in much of the dialogue between science and religion. While, as Kuhn points out, paradigms are essential for normal science to proceed, outdated paradigms limit the fruitfulness of dialogue.

A rather sweeping proposal

As an example of what may be accomplished in breaking free of the limitations imposed by the Grand Material Metaparadigm and the errors discussed above, consider the following assumptions:

(1) God exists and is too complex for human understanding. (Perhaps God works through an implicate order, as suggested by Bohm[34] and Sharpe.[35])
(2) God's existence stands at the top of a multidimensional chain of actuality, perhaps describable as a heirarchy of dimensional universes. (Here I distinguish between the reality of individual perceptions and the actuality of externals on which all rational beings who have the necessary observational faculties can agree.)
(3) Each lower-dimensional universe stands in the same relation to the next-higher-dimensional universe as does Bohm's two-dimensional camera im-

age to the three-dimensional aquarium.[36] (Organizing principles—the implicate order—in the lower universe result from information passed from the higher ones. Thus, it is impossible fully to understand a given-dimensional universe, while viewing it from a lower dimension.)

(4) From the viewpoint of a higher-dimensional universe, any lower-dimensional one may appear insubstantial; from the reverse point of view, the higher one is likely to contain features invisible from below. (Thus, the fact that "solid objects" are already known to be mostly vacuum inhabited by tiny fragments of matter, which may themselves be only vortices in an energy wave, becomes comprehensible, at least in principle.)

(5) For reasons only known to Godself, God chose to create beings in God's image. (Perhaps for fellowship? Perhaps in the great scheme of things, we represent multidimensional neurons in the evolving brain/mind of God? How should we expect to know God's purposes? We often do well just figuring out our own true purposes in a given action.)

(6) God also created worlds in lower-dimensional universes; these worlds were not intended for habitation by the new creatures.

(7) Because beings created in God's image must have free will, they could choose to act in ways not in harmony with the best development. In particular, some of them chose to enter the lower-dimensional actualities, and then became so immersed in them that they forgot their divine heritage. They began to mistake the part for the all. (Anyone who has a son or daughter with a computer game can easily understand the process!)

(8) God then used the process of guided evolution to create a vehicle for the "lost" creatures to learn their way back into fellowship with their creator.

(9) Since the process was an extended one, and death was a characteristic of the actuality, these creatures had chosen to inhabit, God provided for the creatures successively to inhabit bodies suitable for the lower-dimensional universe, until they learned their lessons. (Learning, here, is a holistic process, not intellectual learning. Since not all lessons could be learned in a single body's lifetime, causes in one lifetime could produce effects in a later one. Also, between lower-dimensional existences, the creatures could choose to experience certain difficult lessons in future existences.)

(10) Further, God sent an advanced creature to establish a pattern to be followed by other creatures in recovering their divine heritage.

(11) The most basic laws of the whole creation are exceedingly simple:

Like begets like.
As above, so below.
Love.

Elaboration of this cosmology has been done with slight variations by numerous intuitives during the last two hundred years. The version with which I am most familiar is that presented in literally thousands of pages of transcripts of intuitive sessions of Edgar Cayce, elaborated in the books by Lytle Robinson, and by Richard Drummond of the University of Dubuque Theological Seminary. Careful thought will reveal that it squarely answers the problems of theodicy, seeming unfairness in the world, the purpose of humans' existence, and other such philosophico-theological vexations. It also provides hypotheses for explaining many of the anomalies that are inexplicable under the Grand Material Paradigm. This cosmology squares with the important doctrines of "all the religions that teach that God is One," in Cayce's words, although some less impor-

tant doctrines will conflict with certain features. For instance, to a traditional Christian, the idea of reincarnation, alluded to in assumption (9), seems foreign. However, the highly respected Anglican theologian, Leslie Weatherhead, includes Origen (in *Contra Celsus* and *De Principiis*), St. Jerome (*Letter to Avitus*), Augustine (*Confessions* 1:6), and St Francis of Assisi among eminent Christians who accepted reincarnation,[37] although the Council of Constantinople (553) "rejected it by a narrow margin."[38] Even though the New Catholic Encyclopedia states that reincarnation is heretical,[39] it makes no mention of when such a proclamation was issued. In fact, the decisions most frequently mentioned in this connection are the anathemas against Origen, which are no longer considered to have been a valid part of the deliberations of the Council.[40] Weatherhead himself presents good cause for supporting reincarnation.

This cosmology is also reasonably compatible with Bohm's, and causes no problems with modern physics. Its compliance with sociobiology is questionable, but by including the concept of reputation in their list of "adaptive" features, the sociobiologists have made their position irrefutable in principle, even if it is dead wrong. Thus, the seeming success of that theory may be illusory.

It is my belief that a successful cosmology must avoid denying basic human beliefs as experienced through all three modes of knowing, and must be able to answer questions on the growing edge of inquiry. Whether the one briefly outlined above is able to do so remains for further elaboration. But I think that it certainly offers a better prospect than most of the other ones being considered today.

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Endnotes:

1. Russell, pp. viii-ix.

2. Helvey.

3. James, p. 42.

4. Ouspensky, *Tertium Organum*, p. 193.

5. Honeycutt, ch. 12.

6. Barbour, p. 111.

7. Matt. 25:31-46; cf. similar concepts in the Qur'an and in the Noble Eight-Fold Path of Buddhism: in Islam, much stress is laid upon *sadaqa*, or almsgiving; and almsgiving is the first of the six *paramitas*, which point toward "right conduct" in Buddhism.

8. James, pp. 329ff.

9. See Robinson; Drummond.

10. See Steiner.

11. Gurdjieff's work is discussed by Ouspensky in his book, *In Search of the Miraculous*.

12. Kittel and Friedrich, p. 953.

13. Armstrong, p. 42. This refusal to consider the possibility that the prophets actually experienced revelation is consistent with the inappropriate title of her book, which cannot logically be what it claims, unless God is a creation of humankind. In fact the book is not even a history of the human understanding of God; it is a survey of certain, carefully selected, academic theological formulations concerning theistic cosmology, which is a quite different thing. A history of humankind's conceptions of God could not be considered complete with-

out discussion of the beliefs of the common person and also without dealing with the rise and growth of the distinctive theologies of the most numerous Christian denomination in North America (the Baptists) or of the fastest-growing Christian denomination (the Pentecostals and their relatives).

14. Ibid., p. 48.

15. Barbour, p. 111.

16. See Armstrong, pp. 210, 214, 232, 396, 397.

17. Davies, pp. 226-232.

18. See Shealy and Myss; Targ and Puthoff; Schwartz. The specific case of objectively verifying statements of prophets/intuitives who predict the future (as many do not!) brings up the special problem of whether the future is knowable. Davies, Barbour, and many others have pointed out that if free will is real, the future may be inherently unknowable, even to God. The generally poor record of intuitives predicting the future, compared with the significantly better record in dealing with medical conditions, remote viewing, and intuitive archaeology, seems to support the inherent unknowability of the future.

19. James, p. 325.

20. Lao Tsu, p. 49.

21. Barbour, p. 271.

22. James, pp. 112ff.

23. Armstrong, p. 281.

24. See Kuhn.

25. Schwartz, pp. 260-261.

26. See Irons.

27. Targ and Puthoff, ch. 4.

28. Dossey, pp. 169-196, 211-149.

29. Vogel, pp. 289-313.

30. Puthoff and Targ, p. 536.

31. See Stevenson, *Twenty Cases*, and *Where Reincarnation and Biology Intersect*.

32. Tiller, pp. 41-95.

33. Jahn and Dunne, pp. 193-288.

34. See Bohm.

35. See Sharpe.

36. Bohm, pp. 187-189.

37. Weatherhead, p. 297.

38. *The Catholic Encyclopedia*, "Metempsychosis and the Esoteric Tradition," vol. 10, pp. 234-237.

39. *New Catholic Encyclopedia*, vol. 9, p. 735.

40. Hefele, vol. iv, pp. 223-227.

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La Evolución de la Consciencia y la Acción de Dios en el Mundo

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En este trabajo se analizará, a partir de las obras de Teilhard de Chardin, Karl Rahner, Karl Schmitz-Moormann y George Ellis, cómo la consciencia ha seguido un proceso evolutivo que ha posibilitado la aparición de seres humanos en la Creación. Por otra parte, se tratará también de hacer una reflexión sobre cómo ha influido la acción de Dios en dicho proceso, es decir, de qué forma concreta realiza Dios su acción en el mundo.

Introducción

Uno de los grandes retos del ser humano ha sido siempre el de encontrar el significado de su propia realidad en el marco del Universo. Lo que Pierre Teilhard de Chardin dio en llamar *la paradoja humana* sigue estando vigente más de medio siglo después: por más que la ciencia avanza (de hecho sabemos ya con toda seguridad que somos bioquímicamente comparables al resto de los seres vivos) sigue habiendo una dimensión de nuestra realidad que nos desconcierta y que no somos capaces de definir adecuadamente. Es por esto que a lo largo de nuestra historia nos hemos preguntado repetidamente dónde reside ese aspecto que nos hace distintos, únicos; o planteándolo de otro modo... ¿qué es lo que nos diferencia del resto de los animales?

Ofrecer una respuesta satisfactoria a esta pregunta resultaría ciertamente muy complicado. Sin embargo, si intentamos una primera aproximación, encontramos algo interesante:

Por lo que sabemos (y hablando de forma muy general), el animal observa su entorno detenidamente, y a continuación lleva a cabo una evaluación sobre la base de los datos obtenidos mediante sus mecanismos sensoriales. Si reconoce el ambiente como favorable, lo aprovecha según sus necesidades, y si le es desfavorable lo abandona y busca otro espacio.

En cambio el ser humano observa detenidamente su entorno... y se asombra. Su complejo sistema nervioso le ofrece una gran cantidad de datos de una elevada precisión. Pero la clave no parece radicar aquí (sabemos que algunos animales poseen mecanismos muy sofisticados y eficientes, como el sonar de los murciélagos y de las ballenas azules, que nosotros no poseemos de forma natural). Tal vez la clave, como decíamos, no radique aquí, sino en nuestra capacidad de asombro. ¿Y por qué es tan importante esta capacidad? Porque nos conduce directamente a lo que constituye toda una innovación dentro de la escala evolutiva: *la reflexión*.

Podríamos decir que la capacidad de reflexión proviene de una dimensión del individuo que es inherente al ser humano, pero sería complejo determinar de dónde proviene esta capacidad, en qué se concreta. A partir de aquí surgen una serie de cuestiones que se irán desarrollando más detenidamente a lo largo del trabajo (a partir de las obras de diversos autores) pero que apuntamos ahora brevemente:

En la próxima sección, de este trabajo veremos cómo Teilhard asocia esta capacidad al concepto de consciencia, y logra integrar de forma sumamente elegante el Cristianismo y las teorías evolucionistas, cuyos planteamientos respectivos podían ser considerados *a priori* como antagónicos. Con Karl Rahner nos acercaremos al problema de la causalidad en la evolución y, más concretamente, en el momento de la hominización.

Siguiendo de cerca los planteamientos de Teilhard, veremos, en la sección siguiente, que Karl Schmitz-Moormann enfoca la evolución de la consciencia como uno de los parámetros que permiten entender el Universo en evolución como fruto de la acción creadora de Dios. Y aquí encontramos una cuestión fundamental: si es la naturaleza creadora de Dios la que nos ha permitido llegar a ser seres humanos, ¿de qué forma concreta ha intervenido en el proceso? O lo que es lo mismo, ¿cómo actúa Dios en el mundo?

Y en la última sección propondremos, con George Ellis, una serie de respuestas a esta cuestión, analizando las distintas formas en que Dios podría intervenir teniendo siempre en cuenta los criterios de la ciencia moderna.

"El ser humano entró en el mundo sin ruido...."[1]

En efecto, la aparición del género humano se produjo como resultado de un proceso, la hominización, que se desarrolló de una forma muy gradual. Han sido muchos los científicos y los teólogos que han dedicado su esfuerzo al análisis de este proceso, pero a continuación nos acercaremos al pensamiento de solo dos de ellos, ambos de reconocido prestigio: Teilhard de Chardin y Karl Rahner.

Teilhard de Chardin: la hominización y el Punto Omega.

Entre 1938 y 1940 Teilhard elaboró la que sería su obra póstuma de mayor prestigio, *Le phénomène humain*. Su intención (que le causó serios conflictos con las autoridades eclesiásticas del momento) era la de explicar que, lejos de atentar contra los valores religiosos, su interpretación evolucionista mostraba el camino por el que el Creador había conducido al ser humano hasta llegar a ser lo que era (y lo que sería en el futuro).

En esta obra Teilhard comienza haciendo un recorrido por los elementos que constituyen el Universo; la aparición de las primeras moléculas—*la previda*; las primeras formas vivientes—*la vida*; y, por fin, el nacimiento del pensamiento. A partir de aquí su objetivo se centra en hallar la dirección que sigue la evolución, ya que en un momento histórico (alrededor de 1940) en el que gran parte de la comunidad científica acepta ya la validez de las teorías evolucionistas, el interés pasa a centrarse en averiguar si este proceso esta *dirigido* o no, es decir, si existe una orientación concreta.

Dejando de lado cualquier tipo de antropocentrismo estéril, trata en primer lugar de hallar un orden dentro de la inmensa complejidad que presenta el conjunto de los

Este aspecto conduce a Teilhard a la conclusión de que la capacidad de percepción y de análisis de la realidad que posee el sistema nervioso (lo que él denomina "psiquismo") evoluciona progresivamente hasta dar lugar a la conciencia, condición indispensable para un acontecimiento de consecuencias espectaculares: el paso de la Reflexión.

seres vivos. Evidentemente existen muchas características susceptibles de ser consideradas en un estudio serio, pero Teilhard busca aquella en concreto que otorgue al conjunto de los seres vivientes un mayor grado de coherencia. Tras apreciar que en los organismos se da un progresivo crecimiento y profundización de la consciencia, llega a la conclusión de que aquello que indica la dirección de la evolución es la diferenciación del sistema nervioso.

Ahora bien, teniendo en cuenta que la diferenciación de un órgano es potencialmente un factor de superioridad, encontramos un detalle interesante: a pesar de que la especialización paraliza (evolutivamente hablando) y la ultra-especialización puede incluso causar la extinción de una especie, vemos que en los primates se ha mantenido todo en un estado plástico mientras que la actividad se ha dirigido al cerebro.Es decir, que mientras que la anatomía ha cambiado relativamente poco, el sistema nervioso se ha ultraespecificado importantemente; y aquí encontramos lo interesante: en relación a los gorilas, por ejemplo, sabemos que compartimos con ellos un 98,3 % de la información genética, por eso tenemos una estructura corporal (y un sistema nervioso) tan similar; en cambio, en el ámbito de la funcionalidad del cerebro encontramos un salto abismal.

Este aspecto conduce a Teilhard (a pesar de que él no conocía este dato concreto) a la conclusión de que la capacidad de percepción y de análisis de la realidad que posee el sistema nervioso (lo que él denomina "psiquismo") evoluciona progresivamente hasta dar lugar a la *conciencia*, condición indispensable para un acontecimiento de consecuencias espectaculares: *el paso de la Reflexión.*

Resulta un tanto complejo hallar una definición precisa para este concepto, pero Teilhard entiende la reflexión como "le pouvoir acquis par une conscience de se replier sur soi, et de prendre possession d'elle même...: non plus seulement connaître,— mais se connaitrê; non plus seulement savoir, mais savoir que l'on sait."[2] Lo que nos interesa ahora es precisamente cómo se produce ese salto abismal al que antes nos referíamos, que es a fin de cuentas *el nacimiento del Pensamiento* y que constituye una "discontinuidad dentro de la continuidad" en el proceso evolutivo. Intuitivamente pensaríamos que este paso debió realizarse "de una sola vez", pero conceptualmente puede resultarnos una idea muy impactante porque nos sugiere una cierta sensación de "ruptura." En el caso del desarrollo de un individuo (desde que nace hasta que se convierte en un adulto) esta ruptura no tendría para nosotros mayor relevancia. Pero en la embriogénesis filética cada estadio está representado por un ser diferente; aquí no se puede evitar el problema de la discontinuidad ya que, debido a que el paso de la reflexión es un cambio muy radical, no podemos imaginar un individuo intermedio. La solución que propone Teilhard se basa en considerar que la transición se realizó entre dos individuos, ya que "...en toute et pure rigueur scientifique, rien ne nous empêche de supposer que l'intelligence a pu (ou même dû) être aussi peu perceptible extéreurement, à ses origines phylétiques, qu'elle l'est encore, pour nos yeux, en chaque nouveau-né, au stade ontogénique."[3]

Una vez que la transformación se ha producido (y al margen del modo en que entendamos este paso) lo cierto es que la estructura de la Vida se modifica de forma irreversible: el ser humano se libera de un círculo dentro del cual el animal se encuentra prisionero y en el que este parece no tener otra función que la de perpetuar su especie. Así, la hominización del grupo entero conduce a una personalización del individuo. Teilhard utiliza el término "hominización" para referirse al salto que realiza el individuo desde instinto al Pensamiento, y en un sentido más amplio, a

la espiritualización progresiva del grupo humano. Pero este "despertar" no es solo un punto crítico alcanzado y superado, sino que representa una transformación que afecta al planeta entero: si bien la Psicogénesis (que tuvo lugar mediante la concentración del Pensamiento y su proyección hacia delante) nos había conducido al Ser Humano, ésta se difumina ahora y se ve absorbida por una función aún más elevada: el nacimiento y el despliegue completo del Espíritu, la *Noogénesis*.

Teilhard utiliza el término "hominización" para referirse al salto que realiza el individuo desde instinto al Pensamiento, y en un sentido más amplio, a la espiritualización progresiva del grupo humano. Pero este "despertar" representa una transformación que afecta al planeta entero.

Con ella se desarrolla a nivel planetario una nueva capa, por encima de la Biosfera, la *Noosfera*; una capa que tiende a la centralización y en la que "[p]arce qu'il contient et engendre la Conscience, l'Espace-Temps est nécessairement de nature convergente."[4] De esta forma las distintas capas avanzan y convergen en el Punto Omega, que las fusiona y las unifica totalmente.

En este punto pasamos del Fenómeno humano al *Fenómeno cristiano* para encontrar que el Cristianismo contiene una solución del mundo extremadamente simple y en cierto modo atrevida: "Au centre,(...), l'affirmation intransigeante d'un Dieu personnel: Dieu-Providence, menant l'Universe avec sollicitude, et Dieu-Révélateur, se communiquant à l'Home sur le plan et par les voies de l'intelligence."[5] La creación del mundo supone para Dios unificarlo con Él mismo (de acuerdo con el pensamiento griego, que identifica "ser" y "ser uno"). Así, el Universo culmina en una síntesis de centros (entendidos éstos como seres capaces ya de reflexionar), en una Unión en la que Dios es el Centro de los Centros; esto viene a ser, de forma precisa, el Punto Omega. Sin embargo este Universo convergente no nace de la fusión y la confusión de los centros elementales que acumula, sino que es preexistente y trascendente, de acuerdo con su función colectiva y estabilizante. Para Teilhard esta "unidad con Dios" de los centros reflexivos no se consigue mediante una identificación (Dios convirtiéndose en todo), sino por acción diferenciante y comunicante del amor (Dios *todo en todos*).

Karl Rahner: la hominización como "autosuperación."

Encontrar una "definición" adecuada para el concepto de Ser Humano es una cuestión que ha sido largamente discutida y que todavía continúa abierta. Aun así, tanto las filosofías como las religiones han asumido una concepción dualista del ser humano en la que éste se divide en cuerpo (sometido a la degradación y la temporalidad de la materia) y alma (eterna y unida a un ámbito celestial o divino). En caso de que se introduzca el cerebro en esta perspectiva dualista, se suele entender bien como un órgano de unión entre el cuerpo y el alma, o bien como un elemento complementario a la mente (en cuyo caso cerebro y mente son indisociables).

Ahora bien, tal como lo hace notar Karl Rahner en su trabajo "Die Hominisation als theologische Frage," esta desintegración de

la naturaleza humana no resulta lícita. Para Rahner, la evolución del cuerpo (o de la dimensión material) representa el origen del nacimiento de alma; es decir, que la materia y el espíritu mantienen un parentesco, son dos aspectos distintos que se concretan en una misma realidad. El problema es ahora cómo esa realidad material puede evolucionar hacia algo que le supera esencialmente; la solución se da, como veremos, mediante la *autosuperación*.

Para llegar a este concepto resulta necesario abordar primero la cuestión de cómo interviene Dios en el mundo. En el esquema rahneriano (y aludiendo estos conceptos de forma muy simplificada) la actividad que Dios realiza puede ser de tipo *trascendental* o de tipo *categorial*. En la primera, Dios constituye el fundamento de toda realidad en su ser y su actuar, pero esta actividad no puede ser nunca objeto de nuestra propia experiencia; la acción de tipo categorial, en cambio, implica una intervención directa y sensible en la realidad de nuestro mundo.

Por otra parte, la tradición católica ha afirmado la creación inmediata del alma con la evolución del cuerpo, evitando así un problema fundamental: el de la realidad del hombre. Sin embargo, esto podría llevarnos a recurrir a una acción de tipo categorial por parte de Dios con el fin de argumentar la hominización. Pero esto implica una serie de dificultades, ya que estaríamos "forzando" una irrupción de Dios en el ámbito de las causas segundas y además supondría un escándalo a nivel científico.

En este punto, Rahner se plantea la siguiente pregunta: ¿Es necesario concebir la creación del alma como fruto de una acción categorial de Dios? Su respuesta es negativa, ya que esta creación se explica suficientemente mediante la acción trascendental hominizante: por un lado, autosuperación (concepto según el cual realizarse es realmente autotrascenderse, ya que el agente, partiendo de algo inferior, produce algo nuevo que rebasa ya al propio agente). Si por otro lado tenemos en cuenta, además, la interrelación materia-espíritu que antes comentábamos, no resulta imposible que la evolución de la materia conduzca al espíritu.

Lo cierto es que no se puede negar la existencia de ciertas realidades (tales como la fe, la vida o la propia consciencia) sobre las cuales poseemos un conocimiento auténtico, sólo porque no seamos capaces de definirlas correctamente.

Por tanto, podemos concluir, con Rahner, que la "creación del alma" es básicamente *realización autosuperante*, y que no debe entenderse esta creación como producto de una acción divina categorial sino como una acción de tipo trascendental (concebida ésta no simplemente como un "acompañar" al mundo soportando las leyes físicas, sino más bien constituyendo el fundamento del proceso de la autosuperación).

La Creación: El Universo en Evolución.

En su obra *Theology of Creation in an Evolutionary World*, Karl Schmitz-Moormann ofrece una interpretación del Universo que sigue muy de cerca a la concebida por P. Teilhard de Chardin. Sin embargo, su intención no es exponer su pensamiento, sino presentar una visión teológica de la Creación teniendo en cuenta el proceso evolutivo en que se halla inmerso el Universo. En lugar de comenzar por lo que sería el principio (como lo hacen la Biblia, la Cosmología, etc.) Schmitz-Moormann prefiere empezar por aquello que

él cree que es la clave para entender el Universo: el Ser Humano. Para analizar el proceso evolutivo que éste ha experimentado se basa en tres parámetros: consciencia, información y libertad.

La consciencia en el Universo.

Buscando la dirección que sigue el proceso evolutivo, Schmitz-Moormann introduce la unión y la consciencia como los primeros parámetros del universo que es necesario integrar en una descripción coherente de la evolución (tal como lo hizo también Teilhard), ya que adquiriendo y desarrollando esa consciencia, convirtiéndose en consciente, el universo se pone en camino hacia Dios. Volvemos a encontrar el problema de asignar una definición para este concepto, pero lo cierto es que no se puede negar la existencia de ciertas realidades (tales como la fe, la vida o la propia consciencia) sobre las cuales poseemos un conocimiento auténtico, sólo porque no seamos capaces de definirlas correctamente. Un segundo problema sería que, por un lado, vemos que el proceso evolutivo esta dominado por la dimensión temporal; pero por el otro, creemos en un Dios cuya naturaleza es eterna. El hecho es que a nosotros el concepto de eternidad nos resulta intelectualmente inaccesible y nos conduce a una teología negativa (solo podemos hablar de la eternidad en términos negativos). Incluso aunque no seamos capaces de resolver esta paradoja, lo que sí vemos es que partiendo de la creación del tiempo Dios crea también la "dimensión del devenir". Esta parece ser la única dimensión con un sentido auténtico en el Universo, ya que a través del tiempo la humanidad evoluciona y avanza en su relación con Dios.

La evolución de la información.

El segundo parámetro que propone Schmitz-Moorman para determinar la dirección del proceso evolutivo es la *información*; y al igual que sucedía con el parámetro anterior, el nivel de información parece difuminarse a medida que retrocedemos en la escala evolutiva. Mientras nos encontramos en el nivel atómico no podemos distinguir entre la información que contienen estos elementos y su propia estructura. Esta situación experimenta un cambio radical con la aparición de la Vida: las moléculas que forman parte de los organismos pasan a ser "elementos transportadores" de información, en los que sí podemos distinguir claramente entre la estructura molecular y la información que ésta contiene. A medida que progresa la evolución, crece gradualmente la independencia de la información respecto al transportador (mediante su almacenamiento, codificación y comunicación).

Tal como estamos viendo, la evolución otorga a la información una clara trascendencia sobre la estructura material: asistimos a un primer paso de la materialidad a la espiritualidad, poniendo de manifiesto que la dimensión espiritual es la que da más sentido del Universo. Según Schmitz-Moormann, para el cristiano no debería suponer un problema ver, en esta evolución orientada y dirigida por la información, la obra del Creador. Éste hace posible que sus criaturas se tornen cada vez más similares a Él y que de este modo puedan participar de Su plenitud espiritual (lo que para Teilhard sería el camino que recorre el Ser Humano hacia el *Punto Omega*).

Si observamos el Universo desde este punto de vista, podremos apreciar que este ascenso de la realidad espiritual a niveles cada vez superiores únicamente concierne a una pequeña parte del Universo: una cierta parte de éste se compone de radiación de fondo (sin estructuras de partículas materiales). La parte del universo que tiene estructura molecular es muy pequeña; y la mayor parte, aunque tenga estructura atómica, está constituida por estrellas que no tienen (ni tendrán) las condiciones que la vida requiere para poder desarrollarse. Esto nos llevaría a plantearnos si detrás de esta realidad (que en términos cosmológicos equivale a una masa-energía pequeñisima) existe algún propósito definido.

La evolución de la libertad y la kénosis de Dios en la creación.

Para Schmitz-Moormann la respuesta a este enorme gasto de materia-energía invertido en la creación es *la libertad*, de manera que la introduce como otro parámetro (vistas ya la consciencia y la información) a tener en cuenta en el proceso evolutivo. Cabría la alternativa de considerar que el Universo está rígidamente determinado por una serie de leyes naturales sostenidas de forma continua por un Dios inmutable e impersonal. Pero ésta sería una perspectiva en la que no tendría espacio la libertad, como tampoco tendría sentido ningún tipo de responsabilidad moral. Si bien el enfoque determinista no convence a Schmitz-Moormann, tampoco lo hace el "indeterminista."[6]

Sin embargo es necesario evitar una concepción idílica del Universo, ya que éste, precisamente por el hecho de no estar sometido al determinismo al que antes nos referíamos (es decir, por ser la libertad uno de sus parámetros fundamentales) se encuentra abierto a la imperfección: nuestra naturaleza no es un tranquilo prado donde descansan gacelas y leones, sino una compleja red de cadenas tróficas donde reina la ley del más fuerte y donde ciertamente abundan los "colmillos y garras ensangrentadas". Nuestro mundo evoluciona, sí, pero cada nueva adaptación supone la pérdida, por el camino, de una enorme cantidad de vidas; el dolor, el sufrimiento, la enfermedad, la muerte... y, en definitiva, el mal, están presentes a cada nuevo paso de la evolución.

En el caso de los seres humanos deberíamos añadir, además, el mal moral. Ahora bien, un mundo exento de mal tendría que ser completamente determinista, de manera que tampoco existiría la libertad. Y precisamente la libertad es la condición necesaria para que nazca la capacidad de *amar*: amar a los hermanos y amar a Dios. Para Schmitz-Moormann la intención de Dios no era crear un universo perfecto, sino dar cabida a un mundo en el que las personas tienen capacidad para amar a Dios libremente, que es la única forma en la que el amor es posible.

Es importante recordar, que ya en su momento el Concilio Vaticano II se refería al mundo "que los cristianos creen fundado y conservado por el amor [ex amore] del Creador," subrayando así la definitiva importancia del amor como principio por el cual fue creado nuestro mundo—y en contraposición al ex nihilo que se había formulado tradicionalmente.

El "precio" que pagamos por ello es la enorme cantidad de dolor que encontramos en la creación: es por esto que nos cuesta entender que Dios, que es amor, pueda permitir todo ese sufrimiento y todo ese mal. Schmitz-Moormann piensa que esta dificultad, más que ser un signo de la compasión humana, es un signo de que los seres humanos infravaloramos el alto precio que Dios paga por nuestra libertad: su kénosis. Porque nos ama, sufre con nuestro dolor; sufre, y sin embargo lo acepta para que nosotros podamos vivir y amar libremente. Y no solo eso, sino que paga por ello el precio mas alto: la encarnación, la vida, la pasión y la muerte en la cruz de Su propio hijo: aceptando, en ellas, su propia vulnerabilidad.

Dios, creador ex amore

La creación, tal como ya observó Teilhard, encuentra en la evolución el camino para acercarse cada vez más a Dios. No se trata de que Él ejerza Su poder para dirigir el proceso, sino que envía al Espíritu

Santo para que trabaje en la creación: Dios llama al mundo a una unión de una magnitud cada vez mayor, pero sin forzar a los "elementos" a que se unan. En el ámbito de las relaciones humanas, a esta forma de aceptar al otro y de ofrecerse uno mismo sin imponerse lo llamamos amor.

En efecto, Dios nos ama con una paciencia infinita, tanto, que ha aceptado esperar miles de millones de años (desde el inicio del Universo) hasta que su llamada (lo que Schmitz-Moormann llama "God' s loving creative call") ha encontrado respuesta en la Humanidad.

Es importante recordar, en este sentido, que ya en su momento el Concilio Vaticano II en su constitución pastoral *Gaudium et Spes* se refería al mundo "que los cristianos creen fundado y conservado por el amor del Creador" ("mundum, quem christifideles credunt ex amore Creatoris conditum et conservatum"),[7] subrayando así la definitiva importancia del amor como principio por el cual fue creado nuestro mundo, y en contraposición al *ex nihilo* que se había formulado tradicionalmente.

Para Ellis la suspensión del orden natural que implicarían los milagros supone un problema porque precisamente es la regularidad de las leyes físicas lo que garantiza la libertad y la responsabilidad moral de los seres humanos.

La Acción de Dios en el Mundo

Acabamos de ver cómo la evolución es, en pocas palabras, la herramienta que usa Dios para llevar a cabo su creación *ex amore*. Este planteamiento puede formularse científica-mente de forma muy elegante, tal como lo hace Ellis en su artículo "The Theology of the Anthropic Priciple."[8] El Principio Antrópico formula la existencia de una serie de constantes muy bien sintonizadas que permiten (Weak Anthropic Principle) o incluso que exigen (Strong Anthropic Principle) que la evolución biológica dé lugar a personas humanas.[9] En cambio el Principio Antrópico Cristiano exige, además de estas constantes ajustadas de forma tan precisa, una serie de condiciones que permiten que el fruto de la evolución sean personas capaces de contestar amorosamente a Dios (ya que teológicamente, por el hecho de ser esta creación *ex amore*, no tendría sentido una creación carente de personas con esta capacidad). Estas condiciones[10] son cinco:

1. *Legalidad.* Es necesaria la existencia de leyes físicas constantes que posibiliten la responsabilidad moral de las personas, ya que gracias a esta constancia que rige la actividad de los fenómenos naturales la persona es capaz de advertir las consecuencias de sus acciones en el mundo.

2. *Libertad humana.* Ésta ha de ser permitida a pesar de esas leyes físicas constantes; esta condición exige la posibilidad de que la iniciativa divina no sea correspondida por parte del individuo (mediante el mal moral o pecado).

3. *Imparcialidad.* El hecho de que las leyes físicas sean universales garantiza que la persona pueda ser creyente o no creyente en Dios (en efecto, la experiencia nos demuestra que la lluvia cae tanto sobre los primeros como sobre los segundos).

4. *Naturaleza oculta de Dios.* Éste no se impone a la persona humana, pero ésta puede llegar a Él mediante un cierto conocimiento de tipo natural.

5. *Posibilidad de revelación divina.* A pesar de su naturaleza oculta Dios puede manifestarse, por ejemplo, a través de

intervenciones a nivel del cerebro (un claro exponente de esta posibilidad de revelación divina lo encontramos en la figura del hagiógrafo).

En otro artículo suyo, "Ordinary and Extraordinary Divine Action,"[11] Ellis realiza un análisis del modo en que puede darse la acción divina (análisis que, como veremos, sigue un curso paralelo al del planteamiento realizado ya por Rahner).

En primer lugar describe las acciones divinas *ordinarias* (que viene a ser lo que Rahner llama acción trascendental[12]), que son el resultado únicamente de las leyes físicas (en las cuales la acción divina tendría un papel secundario, a parte de su acción primaria en el establecimiento de dichas leyes). En ellas Ellis incluye la creación y mantenimiento del Universo (que comprende el establecimiento de las leyes físicas y de las condiciones de contorno que éstas necesitan como complemento); la sustentación de los sistemas vivos generales: la evolución (incluyendo a los seres humanos) y, por último, "the enabling of the functioning of the brain and mind: foundations of consciousness and free will."[13]

De esta forma quedaría ya explicado cómo se da la acción divina en el mundo, pero según el esquema de Ellis son necesarias nuevas intervenciones de Dios, las acciones divinas *extraordinarias*. Si bien éstas no serían necesarias para la hominización en sí, sí lo son para que sea posible la existencia de seres capaces de corresponder al amor de Dios (que son precisamente los seres a los que se refiere el Principio Antrópico Cristiano).Estas acciones divinas extraordinarias poseen un carácter revelador (expresan la intención de Dios) y no pueden ocurrir como resultado de las leyes de la lógica y la física (actúan sobre un universo ya existente; en el esquema rahneriano este tipo de acción vendría a corresponder a la acción categorial).

Ellis diferencia dos tipos. En primer lugar tenemos las acciones de tipo *revelatorio*, que nos dan a conocer la naturaleza y el significado de la realidad, proporcionando un discernimiento bien de tipo espiritual o bien de tipo moral (para que se pueda dar esta revelación es necesario que exista algún tipo de "canal de comunicación" que Dios podría utilizar para transmitir a la humanidad información, imágenes y emociones, así como lo que Ellis llama "preconceptual intimations of the nature of reality."[14]

En segundo lugar tenemos las acciones de tipo *excepcional*, cuyo resultado físico no se habría dado de otra forma: los milagros. Ahora bien, éstos constituyen acciones que implican la suspensión de las leyes físicas, y por tanto presentan un problema físico importante (si, por ejemplo, se varía la masa-energía en un determinado espacio-tiempo la perturbación de la conservación de la masa-energía se extenderá al resto del universo).

Para Ellis la suspensión del orden natural que implicarían los milagros supone un problema porque precisamente es la regularidad de las leyes físicas lo que garantiza la libertad y la responsabilidad moral de los seres humanos. Así, "Excepcional divine action can take place only in the case of events that make a unique and vital diference to the future evolution of humanity as a whole."[15] El ejemplo típico sería la Resurrección de Cristo, lo cual es una anticipación de la escatología, en la que funcionarán otro tipo de leyes distintas de las leyes físicas que rigen nuestro mundo.

Epílogo

Para todos aquellos que estudiamos Ciencias de la vida, la evolución es un proceso con el que todos nos hemos tropezado antes o después, desde uno u otro ángulo (aunque puede decirse que son pocos los que conocen esta materia con una cierta profundidad). Por otra parte, todos aquellos que somos cristianos encontramos bastante natural el hecho de concebir a Dios como el Creador de todo cuanto nos rodea (a pesar de la dificultad que supondría entender

verdaderamente qué relación existe entre el Creador y la propia Creación). Lo que resulta realmente interesante es el hecho de entender cómo se interrelacionan los conceptos de "evolución" y "creación" y, más en general, cómo es posible integrar conceptos que conciernen tanto a la ciencia como a la religión. La realización de este trabajo me ha dado la oportunidad no solo de conocer la obra de autores de la talla de Teilhard de Chardin, Rahner, Ellis o Schmitz-Moormann, sino también de acercarme a un mundo tan apasionante como lo es el del actual diálogo teología-ciencia.

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Notas:

1. Teilhard de Chardin, p. 203.

2. Ibídem, p. 181.

3. Ibídem, p. 189.

4. Ibídem, p. 288.

5. Ibídem, p. 326.

6. Para Schmitz-Moormann el hecho de plantear el principio de indeterminación como una "parcela" en la que el Creador encuentra la posibilidad de actuar ressulta una idea desafortunada que reintroduce al "Dios tapagujeros" (the God of the Gaps). No obstante, la mayoría de los actuales participantes en el diálogo Teología-Ciencias ven el interés de que el mundo esté abierto a la acción de Dios en ese campo de la indeterminación cuántica, e incluso en el del caos determinista, que puede servir para amplificar las acciones infinitesimales a nivel cuántico.

7. Concilio Vaticano II. Constitución pastoral *Gaudium et Spes*, n. 2, p. 210.

8. Ellis, "The Theology of the Anthropic Principle."

9. Barrow y Tipler.

10. Ellis, *op. cit.*, pp. 387-391.

11. Ellis, "Ordinary and Extraordinary Divine Action."

12. Difícilmente pondría Rahner la creación inicial del mundo como acción trascendental, sino como acción categorial iniciante. Pero Ellis considera que las acciones extraordinarias se dan sobre el mundo ya existente, y estudia la posibilidad de ser considerado el acto inicial de creación como acción de tipo ordinaria.

13. Ellis, *op. cit.*, p. 374. Ellis parece no tener claro si esta consciencia y esta libertad derivan de la intervención de Dios mediante la indeterminación cuántica o bien sobre un "campo mental" que uniría la mente con el cerebro y la materia, y que a la larga podría ser estudiado como cualquier otro tipo de campo físico.

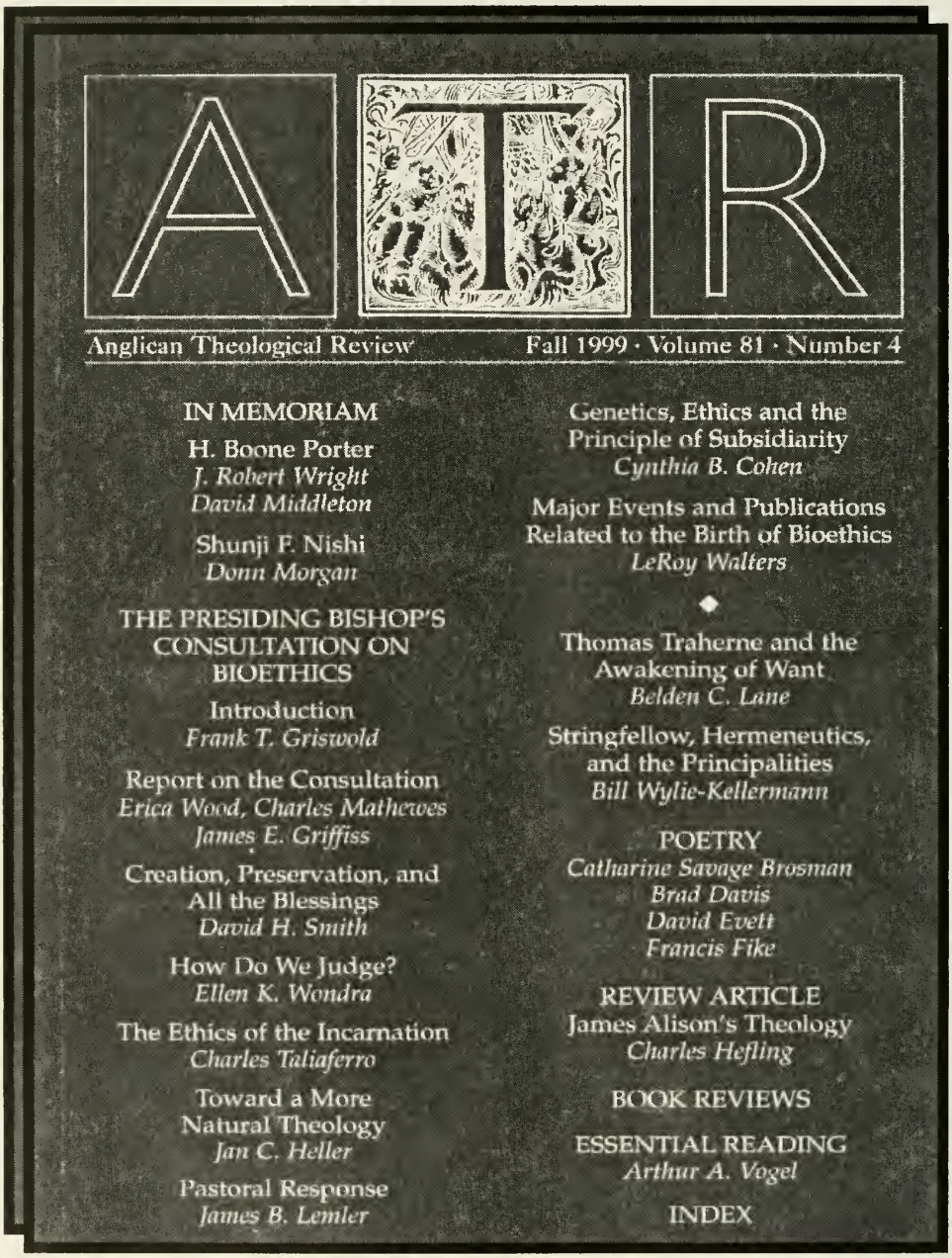
14. Ibídem, p. 381.

15. Ibídem, p. 385.

Noemí Pérez el curso 1998-99 era alumna de segundo curso, en orden a obtener la licencia en Biología en la Universidad Autónoma de Barcelona (UAB), y el presente curso 1999-2000 está estudiando el tercero de los cuatro cursos que se requieren para esa licenciatura. El Instituto de Teología Fundamental (que no depende de la UAB, sino de la Facultad Eclesiástica de Teología de Cataluña—en España, como en Francia e Italia, no existe Facultad de Teología en la Universidad Estatal) ofreció el curso 1998-99 y de nuevo el 1999-2000 una asignatura "Teología y Ciencias hoy" de cinco créditos (50 horas lectivas) dada en el campus de la UAB y convalidable en la UAB como "asignatura de libre elección", dentro de las diversas licenciaturas, entre ellas la de Biología. El artículo es una reelaboración del trabajo que presentó en la primavera de 1999, para obtener una buena calificación, "excelente," en la asignatura "Teología y Ciencias hoy" que acababa de hacer.

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The Evolution of Consciousness and God's Action in the World

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This study, based on the works of Teilhard de Chardin, Karl Rahner, Karl Schmitz-Moormann, and George Ellis, analyzes how consciousness has followed an evolutionary process that has made possible the appearance of human beings in the Creation. It also seeks to reflect on how the action of God has affected this process, i.e., in what concrete way God undertakes action in the world.

Introduction

To find the meaning of their own reality in the context of the universe has always been one of the great challenges for human beings. What Pierre Teilhard de Chardin called *the human paradox* is still relevant over half a century later: however much science advances (in fact, we already know with complete security that we are biochemically comparable to other living beings), there continues to be a dimension of our reality that disconcerts us, one that we are unable to define adequately. For this reason, throughout our history we have repeatedly asked ourselves where this aspect that makes us different and unique resides. Or, to put it another way, what is it that distinguishes us from other animals?

To offer a satisfactory reply to this question would certainly be very complicated. However, a rough first approach yields something interesting. As far as we know, and talking in very general terms, animals observe their environment carefully, and then make an evaluation on the basis of the data received through their sensory mechanisms. If an animal finds the environment favorable, it takes advantage of it according to its needs. If the environment is unfavorable, the animal abandons it and looks for another space. Instead, human beings observe their environment carefully...and are struck with awe. Their complex nervous system offers a large amount of very precise data. But the key does not appear to lie here, for we know that some animals possess very sophisticated and efficient mechanisms, such as the sonar of bats and blue whales, which we do not naturally possess. Perhaps the key does not lie here, but in our capacity for awe. Why is this capacity so important? Because it leads us directly to what is a complete innovation on the evolutionary ladder: *reflection.*

It could be said that the capacity for reflection comes from a dimension that is inherent to human beings, but it would be difficult to determine where this capacity comes from, on what it is based. A series of questions arise at this point, which will be developed more thoroughly throughout this paper.

The next section explores how Teilhard associates this capacity for reflection to the concept of consciousness. He manages to integrate in a highly elegant way Christianity and evolutionary theories, whose respective principles could *a priori* be viewed as antagonistic. In addition, this section looks at Karl Rahner's approach to the problem of causality in evolution and, more concretely, at the moment of humanization.

The following section shows how Karl Schmitz-Moormann, following on closely

from Teilhard's arguments, approaches the evolution of consciousness as one of the factors that enable us to understand the universe in evolution as the result of the creative action of God. Here a fundamental question arises: If it is the creative nature of God that has enabled us to become human beings, in what concrete way has God intervened in the process? Or, which adds up to the same thing, How does God act in the world?

In analyzing the different ways in which God could intervenè, the final section proposes, with George Ellis, a series of answers to this question, with the tenets of modern science always in mind.

"Man came silently into the world."[1]

In effect, the appearance of human beings occurred as the result of a process, humanization, which developed very gradually. Many scientists and theologians have devoted their efforts to analyzing this process. The work of only two of them will be examined here, both of recognized prestige: Pierre Teilhard de Chardin and Karl Rahner.

Teilhard de Chardin: humanization and the Omega Point

Between 1938 and 1940 Teilhard wrote what would be his most renowned work, *Le phénomène humain*, published posthumously. His intention, which brought him into serious conflict with the ecclesiastical authorities of the time, was to explain that, far from attacking religious values, his evolutionary interpretation showed the way along which the Creator had led human beings to what they are and what they would be in the future.

Teilhard begins this work with a journey through the elements that make up the universe: the appearance of the first molecules—*pre-life*; of the first living forms— *life*; and finally, the birth of thought. From this point, he focuses on finding the direction followed by evolution, since at the time he was writing, most of the scientific community already accepted the validity of evolutionary theories, and much interest centered on finding out whether this process was *directed* or not, i.e., whether a concrete guidance existed.

Rejecting any kind of sterile anthropocentrism, Teilhard first tries to find an order within the immense complexity of living beings in their entirety. Clearly, there are many features that can be examined in a serious study, but Teilhard searches for that particular characteristic that confers greater coherence on living beings in their entirety. After appreciating how steady growth and deepening of consciousness occurs in organisms, he reaches the conclusion that what signals the direction of evolution is the differentiation of the nervous system.

Of course, since the differentiation of an organ is potentially a factor of superiority, an interesting point presents itself: although specialization paralyzes, talking in evolutionary terms, and over-specialization can even cause the extinction of a species, it is clear that in the case of primates, everything has been kept in a plastic state, while activity has been directed to the brain. That is to say, while anatomy has changed relatively little, the nervous system has over-specialized to an important extent. And this is the interesting point: we know

***Teilhard was led to conclude that the capacity of perception and analysis of reality that the nervous system possesses (what he calls "psychism") evolves steadily until reaching consciousness, the indispensable condition for an event with spectacular consequences:* the step of reflection.**

that our species shares with gorillas 98.3% of our genetic information, which gives us quite similar body structures and nervous systems. Yet, in the area of brain function, we find a giant leap. With this observation (although, of course, he didn't know this specific genetic data), Teilhard was led to conclude that the capacity for perception and analysis of reality that the nervous system possesses (what he calls "psychism") evolves steadily until reaching *consciousness*, the indispensable condition for an event with spectacular consequences: *the step of reflection.*

Finding an exact definition for this concept is not easy, but Teilhard understands reflection as: "le pouvoir acquis par une conscience de se replier sur soi, et de prendre possession d'elle même...: non plus seulement connaître, —mais se connaître; non plus seulement savoir, mais savoir que l'on sait."[2] The concern now is exactly how the abovementioned giant leap occurs, for this is in reality *the birth of thought* and forms a "discontinuity within the continuity" of the evolutionary process. Intuitively we might think this step must have occurred "just once," but conceptually this idea can be very shocking because it suggests a certain sense of "rupture." In the case of the development of an individual (from birth to adulthood), this rupture would not have the slightest relevance. But in phyletic embryogenesis, each stage is represented by a different being. The problem of discontinuity cannot be avoided in that, as the step of reflection is a very radical change, we cannot imagine an intermediate individual. The solution proposed by Teilhard is based on the thought that the transition occurred between two individuals, since "...en toute et pure rigueur scientifique, rien ne nous empêche de supposer que l'intelligence a pu (ou même dû) être aussi peu perceptible extéreurement, à ses origines phylétiques, qu'elle l'est encore, pour nos yeux, en chaque nouveau-né, au stade ontogénique."[3]

Once the transformation has occurred (putting to one side the way we understand this step), the truth is that the structure of life is modified irreversibly: the human being is freed from a circle within which the animal is imprisoned and in which it appears to have no other function than that of perpetuating its species. Thus, the humanization of the whole group leads to a personalizing of the individual. Teilhard uses the term "humanization" to refer to the leap from instinct to thought, which the individual realizes, and in a broader sense, to the steady spiritualization of the human group. But this "awakening" is not only a critical point reached and overcome; it represents a transformation that affects the entire planet. If psychogenesis (which took place through the concentration of thought and its projection forwards) had led to the human being, it now dissolves and is absorbed by a still higher function: the birth and full unfolding of the Spirit. *Noogenesis.*

With this, a new layer above the biosphere is developed over the whole planet, the so-called *Noosphere*. It is a layer that tends towards centralization and in which, "[p]arce qu'il contient et engendre la Conscience, l'Espace-Temps est nécessairement de nature convergente."[4] As such, the different layers

Teilhard uses the term "humanization" to refer to the leap from instinct to thought, which the individual realizes, and in a broader sense, to the steady spiritualization of the human group. But this "awakening" represents a transformation that affects the entire planet.

advance and converge at the Omega Point, which fuses them and unifies them totally.

Turning now from the human phenomenon to the *Christian phenomenon*, one finds that Christianity contains an extremely simple and, to some degree, daring answer to the world: "Au centre, (...) l'affirmation intransigeante d'un Dieu personnel: Dieu-Providence, menant l'Universe avec sollicitude, et Dieu-Révélateur, se communiquant à l'Homme sur le plan et par les voies de l'intelligence."[5] The creation of the world supposes for God unifying it with Godself (in line with Greek thought, which identifies "being" with "being one"). Thus, the universe culminates in a synthesis of centers (understood as beings now capable of reflection) in a Union in which God is the Center of the Centers. This is precisely the Omega Point. However, this convergent universe is not born of the fusion and confusion of the elemental centers which it accumulates, but is pre-existing and transcendent, in accord with its collective and stabilizing function. For Teilhard this "unity with God" of the reflective centers is not achieved through an identification (God being converted into everything), but through the distinguishing and communicating action of love (God *as the All in all*).

But the truth is that the existence of certain realities about which we possess genuine knowledge, such as faith, life, or consciousness itself, cannot be denied just because we cannot define them correctly.

Karl Rahner: humanization as "self-surpassing"

Finding an adequate "definition" for the concept of human being is a challenge that has long been discussed and still remains open. Even so, both philosophies and religions have assumed a dualist conception of human being, by which it is divided into body (subjected to the degradation and temporality of matter) and soul (eternal and united to a celestial or divine field). Should the brain be introduced into this dualist perspective, it is usually understood either as an organ that unites the body and the soul or as a complementary element to the mind (in which case brain and mind are indissociable).

As Karl Rahner remarks in his study, "Die humanization als theologische Frage" (which appears, together with a study by Paul Overhage, in the book *Das Problem der Hominisation*), this splitting of human nature is not legitimate. For Rahner, the evolution of the body (or of the material dimension) represents the origin of the birth of the soul, i.e., matter and spirit maintain a relationship and are two different aspects which are concretized in one same reality. The problem now is how this material reality can evolve toward something that essentially transcends it. The answer lies, as will be seen, in the phenomenon of *self-surpassing*.

In order to reach this concept, the question of how God intervenes in the world must first be tackled. In the Rahnerian schema (and these ideas are alluded to here in a highly simplified way), the activity that God undertakes can be either *transcendental* or *categorical*. In the first, God is the foundation of all reality in its being and acting, but this activity can never be the object of our own experience. The categorical kind of action, however, implies a direct and sensate intervention into the reality of our world.

The Roman Catholic tradition affirms the immediate creation of the soul along with the evolution of the body, so avoiding a fundamental problem, that of the reality of human beings. However, this tradition could

lead one to have recourse to a categorical type of action by God in order to argue for humanization. But then a series of difficulties arises, since it would be "forcing" an irruption of God into the environment of second causes, and it would also be a scientific scandal.

At this point Rahner poses the following question: Is it necessary to conceive of the creation of the soul as the result of a categorical action of God? His reply is negative, as this creation is sufficiently explained by humanizing transcendental action. One aspect of this is "self-surpassing," by which realizing oneself is really transcending oneself, since the agent, starting from something lower, produces something new, which then surpasses the agent. But the above-mentioned matter-spirit interrelationship should be borne in mind, by which it is by no means impossible that evolution of matter leads to the spirit.

Therefore, I conclude with Rahner that the "creation of the soul" is basically self-surpassing realization, and that this creation must not be understood as the product of a categorical divine action, but as an action of a transcendental kind. This is conceived not just as an "accompaniment" to the world supporting its physical laws, but rather as the basis of the process of self-surpassing.

The Creation: The Universe in Evolution

In his book, *Theology of Creation in an Evolutionary World*, Karl Schmitz-Moormann offers an interpretation of the universe which follows very closely Teilhard's arguments. However, Schmitz-Moormann's intention is not to expound his thought, but to put forward a theological view of Creation that includes the evolutionary process in which the universe is immersed. Instead of starting in the beginning (as do the Bible, cosmology, etc.) Schmitz-Moormann prefers to begin with what he thinks is the key to understanding the universe: human beings. He bases his analysis of the evolutionary process that human beings have experienced on three parameters: consciousness, information, and freedom.

Consciousness in the universe

In search of the direction which the evolutionary process follows, Schmitz-Moormann introduces union and consciousness as the first parameters of the universe that have to be integrated into a coherent description of evolution (just as Teilhard also did), since by acquiring and developing this consciousness—becoming conscious—the universe sets out on the road toward God. Once more the problem arises of giving a definition to this concept; but the truth is that the existence of certain realities about which we possess genuine knowledge, such as faith, life or consciousness itself, cannot be denied just because we cannot define them correctly. A second problem is that we see that the evolutionary process is dominated by the temporal dimension, and yet we believe in a God whose nature is eternal. The fact is that the concept of eternity is intellectually inaccessible to us and leads us to a negative theology (we can only talk of eternity in negative terms). Even though we are incapable of resolving this paradox, what we do see is that God starts from the creation of time to create also the dimension of becoming. This seems to be the only dimension with authentic sense in the universe, since through time humanity evolves and advances in its relationship with God.

The evolution of information

The second parameter proposed by Schmitz-Moormann to determine the direction of the evolutionary process is *information*, and, just as occurred with the first parameter, the level of information appears to become more blurred as we go back on the evolutionary scale. At the level of atoms, there is no distinction between the information these elements contain and their structure. This situation changes radically when life appears: the molecules that make up organisms become "carriers" of information,

in which there is a clear distinction between molecular structure and the information it contains. As evolution progresses, the independence of information from its carrier grows steadily (through its storage, codification, and communication).

Apparently, evolution grants to information a clear transcendence over material structure. This may be seen as a first step from materiality to spirituality, affirming that the spiritual dimension is the dimension that gives most meaning to the universe. For Schmitz-Moormann, it should not be a problem for Christians to see the work of the Creator in this evolution guided and directed by information. This enables all creatures to become steadily more like God and so partake of God's spiritual fullness (which for Teilhard is the road human beings follow toward the *Omega Point*).

It is important to remember that Vatican II referred to the world "which Christians believe was founded and conserved by the love [*ex amore*] of the Creator," so underlining the definitive importance of love as the principle on which the world was created—*ex amore*, in contrast to the *ex nihilo* traditionally put forward.

Looking at the universe from this point of view, one can appreciate that this ascent of spiritual reality to higher and higher levels only concerns a small part of the universe, a certain part of which is composed of background radiation (without structures of material particles). The part of the universe that has molecular structure is very small. Most of it, although it has atomic structure, is composed of stars which do not have (and will not have) the conditions that life requires if it is to develop. This situation should lead to the question of whether behind this reality (which in cosmological terms means a very small quantity of matter-energy) any defined purpose exists.

The evolution of freedom and the kenosis of God in the creation

Schmitz-Moormann's answer to this huge expenditure of matter-energy invested in creation is freedom. As such, he introduces it as a third parameter, along with consciousness and information, to consider in the evolutionary process. The alternative would be that the universe is rigidly determined by a series of natural laws sustained continually by an immutable and impersonal God. But this would be a perspective in which freedom would have no space, and moral responsibility would make no sense. Although the determinist focus does not convince Schmitz-Moormann, neither does the "indeterminist" focus.[6]

However, an idyllic conception of the universe should be avoided, since the universe, precisely because it is not subjected to the determinism mentioned above (i.e., because freedom is one of its fundamental parameters), is open to imperfection: Nature is not a peaceful meadow where gazelles and lions rest together, but a complex network of trophic chains where the law is that the strongest prevails, "red in tooth and claw." It is true that our world evolves, but each new adaptation supposes the loss of an enormous number of lives along the road: pain, suffering, disease, death—in short, evil—are present at each new step of evolution. And in the case of human beings, one should add moral evil.

Of course, a world exempt from evil would have to be completely determinist, so that freedom would not exist either. And freedom is precisely the necessary condition for the birth of our capacity to *love*: loving our sisters and brothers and loving God. For Schmitz-Moormann, God's intention was not to create a perfect universe, but to make

room for a world in which people have the capacity to love God freely, which is the only way in which love is possible.

The price to be paid for this freedom is the huge amount of pain found in creation. This is why it is hard to understand that God, who is love, can allow all this suffering and all this evil. Schmitz-Moormann thinks that this difficulty, rather than being a sign of human compassion, is a sign that we human beings undervalue the high price that God pays for our freedom: God's kenosis. Out of love for us, God suffers with our pain—suffers, yet accepts it, so that we can live and love freely. And not only this, but God pays for it the highest price: the incarnation, life, passion, and death on the cross of God's own son, accepting vulnerability in all this.

For Ellis, the suspension of the natural order involved in miracles is a problem precisely because it is the regularity of physical laws that guarantees the freedom and moral responsibility of human beings.

God, creator ex amore

Creation, as Teilhard had already noted, finds in evolution the path to draw nearer and nearer to God. It is not that God exercises power to direct the process, but that the Holy Spirit is sent to work in the creation: God calls the world to an increasingly full union, but without obliging its "elements" to unite. In the field of human relationships, we call this way of accepting others and offering oneself without imposition, love.

In effect, God loves us with infinite patience, so much so as to accept a wait of thousands of millions of years (since the beginning of the universe) until God's call (what Schmitz-Moormann calls "God's loving creative call") finds a response in humankind.

It is important to remember, in this respect, that in its day Vatican Council II, in its *Pastoral Constitution on the Church in the World*, referred to the world "which Christians believe was founded and conserved by the love of the Creator" ("mundum, quem christifideles credunt ex amore Creatoris conditum et conservatum"),[7] so underlining the definitive importance of love as the principle on which the world was created—*ex amore*, in contrast to the *ex nihilo* which had traditionally been put forward.

The Action of God in the World

Thus, evolution may be seen to be, in brief, the tool used by God to bring about His creation *ex amore*. This postulate can be expressed scientifically in a very elegant way, as Ellis does in his article "The Theology of the Anthropic Principle."[8] As proposed by physicists John Barrow and Frank Tipler, the Anthropic Principle posits the existence of a series of very well harmonized constants that permit (in its so-called "weak form") or even require ("strong form") biological evolution to give rise to human beings.[9] However, the *Christian Anthropic Principle* as proposed by Ellis, demands, in addition to these so precisely adjusted constants, a series of conditions that allow the result of evolution to be persons capable of answering God lovingly (since theologically, by the very fact of the Creation being *ex amore*, a creation lacking people with this capacity would not make sense). These conditions[10] are five in number:

1. *Legality.* Constant physical laws that make people's moral responsibility possible have to exist since, thanks to this constancy, which governs the activity of natural phenomena, people are capable of realizing in the world the consequences of their actions.

2. *Human freedom.* This has to be permitted in spite of these constant physical

laws. This condition includes the possibility that the individual (through moral evil or sin) does not reciprocate the divine initiative.

3. *Impartiality.* The fact that physical laws are universal guarantees that the person can believe or not believe in God (in effect, experience shows us that rain falls just the same on the former as well as on the latter).

4. *Hidden nature of God.* This is not imposed on human beings, but they can reach God through a certain knowledge of a natural kind.

5. *Possibility of divine revelation.* Despite a hidden nature, God can show Godself by, for example, interventions in the brain (a clear exponent of this possibility of divine revelation being found in the figure of the hagiographer).

In another article of his, "Ordinary and Extraordinary Divine Action,"[11] Ellis analyzes the way in which divine action can occur (analysis which, as shall be seen, follows a course that runs parallel to Rahner's hypothesis). In the first place, Ellis describes the *ordinary* divine actions (which is much the same as what Rahner calls transcendental action[12]), which are the result solely of physical laws (in which divine action plays a secondary role, apart from its primary action in establishing these laws).

In these laws Ellis includes the creation and maintenance of the universe (which comprises the establishment of physical laws and the complementary boundary conditions these require); the sustaining of the general living systems; evolution, including that of humans; and, lastly, "the enabling of the functioning of the brain and mind [foundations of consciousness and free will]."[13]

How divine action occurs in the world can already be explained in this way; but in Ellis' schema, new interventions of God are needed—*extraordinary* divine actions. Although these are not necessary for humanization as such, they are necessary for the possibility of the existence of beings that could reciprocate the love of God (precisely the beings referred to by the Christian Anthropic Principle). These extraordinary divine actions possess a revelatory character (they express the intention of God) and cannot occur as a result of the laws of logic and physics (they act on an already existing universe: this kind of action is equivalent to categorical action in the Rahnerian schema).

Ellis distinguishes two kinds of extraordinary divine actions. First of all, he describes actions of a *revelatory* kind, which reveal the nature and significance of reality and provide either spiritual or moral discernment. For this revelation to occur, there must be some kind of "communication channel" that God can use to transmit information, images, and emotions to humanity, as well as what Ellis calls "preconceptual intimations of the nature of reality"[14]

Secondly, Ellis describes actions of an exceptional kind, the physical result of which would not otherwise have occurred: miracles. These, of course, are actions that imply the suspension of physical laws, and therefore pose an important physical problem. If, for example, the mass-energy in a determined space-time varies, the perturbation of the conservation of the mass-energy will spread to the rest of the universe.

For Ellis, the suspension of the natural order involved in miracles is a problem precisely because it is the regularity of physical laws that guarantees the freedom and moral responsibility of human beings. As such, "exceptional divine action can only take place when there are uniquely important events, which are vital for the future evolution of humanity."[15] The typical example is the Resurrection of Christ, which is an anticipation of the eschatological moment, when another kind of law, different from the physical laws which govern our world, will come into operation.

Epilogue

For those of us who study the life sciences, evolution is a process that we have all stumbled over at some stage, from one

or another angle (although it can be said that there are few who know this subject in great depth). However, all of us who are Christians find the concept of God as the Creator of everything that surrounds us to be natural enough, in spite of the difficulty involved in really understanding what relationship exists between the Creator and Creation itself. What is really interesting is understanding how the concepts of "evolution" and "creation" are intertwined and, more generally, how concepts that concern both science and religion can be integrated. Undertaking this study has given me the opportunity not only to get to know the work of authors of the stature of Teilhard de Chardin, Rahner, Ellis, and Schmitz-Moormann, but also to approach the thrilling world of the current theology-science dialogue.

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Endnotes:

1. Teilhard de Chardin, English edition, p. 183.

2. Ibid., p. 181.

3. Ibid., p. 189.

4. Ibid., p. 288.

5. Ibid., p. 326.

6. Schmitz-Moormann finds that posing the principle of indeterminacy as a "piece of ground" on which the Creator has the possibility of acting is an unfortunate idea which reintroduces the "God of the gaps". Nevertheless, most current participants in the theology-science dialogues see the relevance of the world being open to the action of God in this field of quantum indeterminacy, and even in the field of determinist chaos, which may serve to extend infinitesimal actions at a quantum level.

7. Vatican Council.

8. Ellis, "The Theology of the Anthropic Principle."

9. Barrow and Tipler.

10. Ellis, op. cit., pp. 387-391.

11. Ellis, "Ordinary and Extraordinary Divine Action."

12. Rahner would be reluctant to pose the initial creation of the world as a transcendental action, but rather as an initiating categorical action. But Ellis considers that extraordinary actions occur in the already existing world, and investigates the possibility of the initial act of creation being considered an *ordinary* kind of action.

13. Ellis, op. cit., p. 374. Ellis does not seem clear about whether this consciousness and this freedom arise from the intervention of God through quantum indeterminacy, or on a "mental field" that would unite the mind with the brain and matter, and that could be studied, in the long term, like any other kind of physical field.

14. Ibid., p. 381.

15. Ibid., p. 385.

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In 1998-99, and again in 1999-2000, the Institute of Fundamental Theology offered a 5-credit (50 lecture hours) course, "Theology and Science Today," on the UAB campus. It was jointly credited with the UAB as a "free elective" in the various "Licencia" programs, including that in biology. The Institute of Fundamental Theology is not part of the UAB, but rather of the Ecclesiastical Faculty of Theology of Catalonia. (In Spain, as in France and Italy, there is no Department of Theology at State universities.) Noemí took this course, completing it with the grade of "Excellent." Her essay is an edited version of a paper she wrote as part of the course requirements.

Molding the Physical World Upon Francis Bacon's Anvil

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This examination of the division of the sciences offered by Thomas Aquinas and Francis Bacon compares the ontological approach to the sciences proposed by Aquinas and the modern pragmatic scientific theory of Bacon. The author weighs a proposed elimination of metaphysics from the thinking of Bacon and its implications for modern scientific thought, concluding finally that metaphysics is extremely important as the governing agent of the sciences.

Before Francis Bacon's time, a student might have questioned three different teachers about the sciences. The first might have taught about the physics or natural science of the world. Another might have guided the student to an understanding of the mathematics locked up inside the mind. While the third might have asked the student to consider the reality of the things closer to God, those divine things. These three divisions are how Saint Thomas Aquinas viewed the sciences.

Since Bacon's time, a student might question only one. A natural scientist might teach a modern version of science that joins physics and mathematics. And that same professor might also try to convince the student that metaphysicians are rightly given offices in the back of the humanities department to contemplate their alternative views of reality. For modern natural scientists, though, the reality of the physical world is deducible, verifiable, and pliable through the use of physico-mathematics. Thus, reality does not exist until it is empirically tested, poked, or prodded. There are those, however, who believe that the reality of the physical world can be perceived without the aid of measurements. Instead, it is beheld ontologically. In this study, then, I seek to comprehend modern natural science's rejection of Aquinas' division of the sciences and its subsequent adherence to the one presented by Bacon.

Aquinas' division of the sciences

Before Aquinas' division of the sciences can be understood, his concept of the human intellect must first be grasped. For Aquinas, the human intellect performs two basic operations. Firstly, one apprehends what a thing is, that is, its essence or nature—what makes a rabbit a rabbit. Secondly, one uses the apprehension of essences to make judgments. Aquinas defines judgment as the ability to compose or divide what is grasped by simple apprehension.[1] Aquinas says that the intellect abstracts what it is that effects simple apprehensions.[2] Abstraction, then, is how he describes what scientists do in their various fields of study. So, in looking at nature, scientists can abstract in one of two ways: they can either abstract form from sensible matter, or abstract the universal from the particular.[3] In abstracting form from matter, one might look at a picture of a triangle and then try to abstract from the picture the triangle's form. What is it that lets

the mind distinguish what a triangle is? One might then say that a triangle's form consists of three straight lines that are connected in such a way as to form three angles with a sum of internal measurement equaling 180 degrees. In abstracting the universal from the particular, one might use, for example, the dissection of a frog. Through such a dissection one seeks to understand how the particular frog under examination digests food or engages in reproduction. After gaining information from the particular frog, one would try to make true universal statements concerning all frogs.

Those who study metaphysics, though, make abstractions using more than simple apprehension, because they are concerned with existence, not just with essence. Whereas simple apprehension is concerned with essence, judgment deals with existence. Aquinas, therefore, calls metaphysical abstraction by the term *separation*.[4] Separation, then, is distinct because it abstracts using negative judgment rather than simple apprehension. The judgment is negative because it denies that being is locked up in matter. Hence, metaphysics maintains an existential character that the other two divisions of science do not.

According to Aquinas, the sciences are first divided into the speculative and the practical. Speculative science strives to discover truth, while practical science uses truth to perform activity. Speculative science is subdivided according to its different objects of speculation; thus, the sciences are further divided into three branches: natural philosophy, mathematics, and metaphysics. The first branch to be considered is natural philosophy—or physics, or natural science. Aquinas says the things studied by this branch of science depend upon matter for their being, as well as for their being understood.[5] Therefore, this branch concerns itself with what is of matter and in motion. Aquinas understands universals in natural philosophy to be abstracted from particulars.[6]

Bacon immediately divides his doctrine of natural philosophy into the speculative or theoretical, and the practical. The speculative side searches after causes, while the practical focuses on the production of effects. As Bacon puts it, "the one enter[s] into the bowels of nature, and the other form[s] her upon the anvil."

As to the nature of these universals, they may be abstracted in two different ways: They may be abstracted

> in themselves; and then they are thought of without motion and determinate matter. This happens to them only by reason of the being they have in the intellect.[7]

Alternatively, they

> can be viewed in relation to the things of which they are the natures; and these things exist with matter and motion. Thus they are principles by which we know these things, for everything is known through its form.[8]

In other words, the mind abstracts the form of a rabbit, for example, after having seen one in the physical world. And after the rabbit's form is determined, one is able to compare it to knowledge of other forms.

Concerning mathematics, Aquinas says that it deals with what does not require matter for its being, but does require matter for its being understood.[9] Thus, mathematics is the abstraction of form from matter. This

matter is not sensible matter, but intelligible matter. Aquinas says that

> a form can be abstracted from matter if the essential nature of the form does not depend on that particular kind of matter; but the intellect cannot abstract form from the kind of matter upon which the form depends according to its essential nature.[10]

This, in other words, is the type of abstraction mentioned earlier in the triangle example. So, Aquinas argues, accidents are related to their substance as form is related to matter; and because it is the nature of accidents to depend on their substances, forms of this kind rely on substance.[11] Quantity, then, is in substance, before the sensible qualities (quality, passivities, and action) are attached to it. Therefore, Aquinas says, accidents are abstracted, and what is left is the substance, intelligible only to the intellect.[12] Substance, then, because it is beyond the human senses to comprehend, is abstracted by mathematics.

There is another division of science that Aquinas mentions within his discussion of mathematics. It falls somewhere between two branches formed by natural science and mathematics. It falls between the two divisions, because physical reality functions in their material structure, while mathematics functions in their formal structure. Aquinas says this branch of science, including astronomy and music, makes mathematical conclusions to prove natural things.[13]

Concerning mathematics, Aquinas says that it deals with what does not require matter for its being, but does require matter for its being understood. Thus, mathematics is the abstraction of form from matter.

Consider Aquinas' third branch of science: metaphysics—or divine science or theology. Metaphysics is the abstraction of things without matter and without motion. These divine things are to be studied in two ways: "first, insofar as they are common principles of all things, and second insofar as they are beings in their own right."[14] Aquinas says these common principles can be realized, only as they reveal themselves.[15] The second way is to learn not from the effects of these principles, but from what the principles reveal about themselves. The first of these methods describes the metaphysics of the philosophers, while the second is the theology of the Sacred Scriptures. The metaphysics of the philosophers that Aquinas describes is based upon the Aristotelian concept of primary philosophy or theological science. (The term "metaphysics" was given later, by the Peripatetic tradition.[16]) Aristotle's metaphysics considers things from the viewpoint of their being,[17] which is the unchangeable, in contrast with the ever-changing world around us. Hence, Aquinas says metaphysics is the study of that which is without matter or motion. The theology of the Sacred Scriptures, however, deals with the Christian concept of God. In particular it is concerned with God's relationship to Creation through the divine revelation and through the Son, Jesus Christ.

Bacon's division of the sciences

For Bacon, the structure of the sciences is analogous to a pyramid. The base is natural philosophy; just above the base is physics; just underneath the vertex is metaphysics; and, finally, the vertex is the summary law of nature that God used to create the universe.[32] Bacon expects no human inquiry will ever reach the knowledge represented by the vertex.

Beginning at the base of the pyramid, Bacon's analysis of natural philosophy di-

vides it into the speculative or theoretical, and the practical. The speculative side searches after causes, while the practical focuses on the production of effects. As Bacon puts it,

> [t]he one enter[s] into the bowels of nature, and the other form[s] her upon the anvil.[18]

Bacon argues one should always treat speculation as distinct from operation.[19]

The speculative branch of natural philosophy is further divided into physics and metaphysics. Bacon then divides physics into three categories: the physics of the principle of things, the physics of the structure of the universe, and the physics of "all the possible varieties and the lesser collections of things."[20] This third category is comprised of the physics concerned with concretes and the physics concerned with abstracts. Bacon says that the first examines "substances, and all the variety of their accidents," while the second deals with "accidents through all the variety of substances."[21] He explains that an inquiry into a lion or an oak supports many different accidents, while an inquiry into heat or gravity will be found in different substances.

For Bacon, the structure of the sciences is analogous to a pyramid: the base is natural philosophy; just above the base is physics; just underneath the vertex is metaphysics; and, finally, the vertex is the summary law of nature that God used to create the universe.

In this study, I focus on the physics of the concretes, because of its impact on the field of astronomy, which uses mathematics to confirm its version of reality. Bacon questions the validity of inquiries into the physical causes of the heavenly substances, because of scientists' reliance on mathematics to explain the events. As he says,

> [p]ains have been chiefly bestowed in mathematical observations and demonstrations; which indeed may show how to account for all these things ingeniously, but not how they actually are in nature: how to represent the apparent motions of the heavenly bodies, and machines of them, made according to particular fancies; but not the real causes and truth of things.[22]

He goes on to say that astronomy has taken its place among the noblest of the physics, because of its reliance on mathematics. Joseph Devey, editor of a 1901 edition of Bacon's *Advancement of Learning*, explains that even "the most acute minds are no more privileged than the weakest to decide questions in relation to things of which they are perfectly ignorant."[23] Bacon, indeed, desired science to reach beyond strict empiricism but failed to admit, at times, that mathematics was (and is) viewed as the vehicle to this goal. Devey contends that only through the use of mathematical forms did astronomy so quickly transform itself into the "highest of the deductive sciences."[24]

Bacon embraces mathematics as the third part of natural philosophy, after physics and metaphysics. In fact, he argues that mathematics is an "appendage or auxiliary" to both the speculative and practical sciences.[25] He goes on to divide mathematics into what is pure and what is mixed. Pure mathematics is concerned with the "sciences employed about quantity, wholly abstracted from matter and physical axioms."[26] This form of mathematics is comprised of geometry and arithmetic. The "mixed" sort of mathematics helps with a better understanding of the parts of physics, for, as Bacon contends, "without the help of mathematics many parts of nature could neither be suffi-

ciently comprehended, clearly demonstrated, nor dexterously fitted for use."[27]

Why did Bacon consider mathematics so vital to the two other branches of natural philosophy? He says that since mathematics is concerned with quantity and "quantity is the most abstracted and separable from matter...for this reason it has been more carefully cultivated and examined into by mankind than any other forms...."[28] Because mathematics is so easily learned, it has been (and continues to be) used to expand particular principles and axioms into general theories and laws. As mentioned earlier, astronomy's use of mathematical principles made it the noblest of the sciences.

Metaphysics is the speculative branch of natural philosophy. While physics regards the things that are of matter and in motion, metaphysics deals with those things abstracted and fixed. So for Bacon, metaphysics is the inquiry into formal and final causes. In the search for formal causes, he writes:

> [a]n opinion has prevailed, as if the essential forms, or real differences of things, were absolutely undiscoverable by human means; granting this, ...of all the parts of knowledge, would be the most worthy of inquiry.[29]

Bacon argues that this search often leads into theological speculations and, thus, threatens to pollute natural philosophy. So, Bacon claims that metaphysics is defective, because its methods create forms that will never appear.[30] He says that if scholars will "with diligence, seriousness, and sincerity...turn [their] eyes to action and use, [they] may find, and become acquainted with those forms, the knowledge whereof will wonderfully enrich and prosper human affairs."[31] In other words, metaphysics develops knowledge that has no practical use.

However, Bacon does not believe that the search for formal causes is worthless. He says that it offers two positive values. First, it collects all of the axioms of science and tries to unite them into more general notions that can be used by all individuals. The second value of formal metaphysics is that it imputes to the one who gains knowledge of formal causes the ability to "superinduce" nature into all kinds of matter.[33] In other words, Bacon says that those who learn nature's forms will have less trouble operating on nature.

As for the inquiry into final causes, Bacon says that it has perhaps been misplaced in the realm of metaphysics, because they are primarily being sought out by physics. He argues that the handling of final causes has, in fact, driven out the inquiry into physical causes, replacing them with those that are "specious and shadowy."[34]

The fall of metaphysics

For Aquinas, then, science is the general knowledge of things, learned through their causes. However, this is not the same way in which modern natural science perceives the physical world. Aquinas' science does not describe the reality of the world through mathematical formulas, but observes phenomena and relates them intelligibly to their causes. In other words, Aquinas seeks to understand scientific truths using philosophy, rather than mathematics. He says that his search, therefore,

> ...does not simply aim at empirological knowledge gained through controlled observation and measurement of the physical world, but rather at knowledge of the very being and essential structure of things. [My] goal is ontological rather than empirological knowledge.[35]

A revolution during the Middle Ages forever altered the way in which the world views the sciences. This revolution rejected not only an inferior form of physics, Maurer says, but also the philosophy medieval science was built upon.[36] The rejection of the ontological approach led to the advent of positivism, which became accepted as the only valid method of knowing. Science from this time forward was based strictly on empirical data interpreted by mathematics. Maurer argues, however, that this change of focus did not come without a significant cost.

> For if the methods of empirological science are successful in dealing with many problems about the physical universe, they are equally unsuccessful in handling with many others, and indeed these the most important of all, such as the intelligibility of the universe, the nature of man, his ultimate origin and destiny, good and evil, and God.[37]

Baconian thought, then, led the modern movement, claiming that science's goal is no longer ontological, but pragmatic. Pragmatism is exercised by manipulating nature to create various pieces of technology. In other words, the modern movement in science now urged abandonment of the pursuit of those things "most worthy of inquiry," in order to develop products that can be used by humanity. Bacon altered the medieval goal of science by reconstructing its concept of metaphysics. Whereas Aquinas' metaphysics dealt with what transcends nature, Bacon's metaphysics remained within the confines of the physical world, concerned with uniting axioms into universal laws and gaining knowledge of nature, in order to "form her upon the anvil." This metaphysics, however, is not willing to discuss anything that is truly beyond physics.

This alteration in metaphysics, though, denies the defining characteristic of a human being, according to John Paul II, as "the one who seeks the truth."[38] Moreover, the Pope argues, "The thirst for truth is so rooted in the human heart that to be obliged to ignore it would cast our existence into jeopardy."[39] Thus, he says that philosophy (here, metaphysics) was developed by humanity to help answer those questions that cannot be confirmed by experimentation.[40] Modern natural science, though, impedes humanity's search for truth, by insisting that truth is apprehended only through its scientific methods. Therefore, modern natural science monopolizes the determination of what is truth.

John Paul II cautions that scientism, modern natural science's tendency to extend physics into metaphysics, not only asserts that it has the exclusive means to perceiving reality, but also "relegates religious, theological, ethical and aesthetic knowledge to the realm of mere fantasy."[41] Thus, any questions regarding the meaning of life are left to the imagination and are considered subjects unfit for rational discourse. The Pope says that such ultimate questions cannot be ignored, because to do so leads "to the impoverishment of human thought."[42]

Consequently, a new generation of physicists has decided not to forsake their humanity, and to pursue answers to life's ultimate questions. Today's theoretical physicists ponder the metaphysical aspects of reality, but under the guise of cosmology and other purely scientific fields related to the study of the universe's origin. So, can it really be said that theoretical physics is concerned only with the measurable physical world? Richard Morris says,

> [t]he boundaries between physics and metaphysics have become blurred. Questions that would have been considered metaphysical in another age enter into discussions of the origin of the universe.... Meanwhile, some all-embracing theories are proposed that yield unverifiable conclusions and appear similar to the metaphysical systems constantly propose by nineteenth century philosophers.[43]

Thus, it appears that modern theoretical physicists inject metaphysical insights into their research of cosmic origin, while insisting, all the while, that they are only considering aspects of physical reality.

Both Aquinas and Bacon include in their analyses of science a field of study that uses mathematics and physics together to consider aspects of the physical world. It might, then, be said that modern natural science (unbeknownst to itself) uses a scientific method that is the illegitimate child of Aquinas' category of "intermediate science" and Bacon's category of "mixed mathemat-

ics." While both categories use mathematics to understand the realities of the physical world, each man's understanding of the sciences is very different from the other's, and this metaphor must be taken only as suggestive. Bacon defends the usage of mathematics in the sciences because it is easily learned and is notably useful in extending particular principles into general theories of physical reality; nevertheless,

> [a] physico-mathematical theory will be called "true" when a coherent and fullest possible system of mathematical symbols and the explanatory entities it organizes coincides, throughout all its numerical conclusions, with measurements we have made upon the real; but it is in no wise necessary that any physical reality, any particular nature, or ontological law in the world of bodies, correspond determinately to each of the symbols and mathematical entities in question.[46]

John Paul II says it must be understood that scientism, modern natural science's tendency to extend physics into metaphysics, not only asserts that it has the exclusive means to perceiving reality, but also "relegates religious, theological, ethical and aesthetic knowledge to the realm of mere fantasy."

Aquinas argues that reality is not found through mathematics. Modern natural science has adopted Baconian thought and, thus, argues that mathematical interpretations of nature represent physical reality. Therefore, modern natural science asserts that its account of reality is supreme, on account of its use of physico-mathematical science.

Jacques Maritain, however, says that it must be understood that physico-mathematical science is not "formally" a physical science, because it does not grasp the ontological nature of the physical realities it deals with.[44]

> [Its] sole aim is to co-ordinate the physical laws that are made known to us by experiment, but which we could not even express without the aid of mathematics.[45]

In other words, physical reality cannot be comprehended without mathematical help. Thus, Maritain says,

Eddington asserts that modern natural science cannot grasp "very definite conceptions of the objects of the external world," until it replaces their forms "with quantities representing the results of physical measurements."[47] It seeks to relate these measurements in a mathematical manner. Any conclusions that modern natural science reaches, or any truths it claims to attain, however, are valid only because of the mathematical functions science pushes the numbers through; therefore, they do not directly correspond to any physical reality or nature. Modern natural science, though, since the acceptance of Baconian thought, believes that its mathematical explanations of nature directly represent physical reality.

While the knowledge of the physical world may be based on measurements, these numerical values rest "on an obscure foundation that is outside the realm of physics...."[48] However, modern natural science does not acknowledge this and, thus, allows mathematics to determine its version of reality. Ever since the medieval understanding of metaphysics was deleted from the sciences, modern natural science has insisted, unabated, that it maintains the only concept of reality and the only method to perceive it. As Maritain argues, though, metaphysical discipline

must be exercised to prevent physico-mathematical science from the

> ...harmful illusion that leads it to regard itself as a philosophy of nature and to believe that things begin to exist only when they are measured by our instruments.[49]

Hence, the vital role of medieval metaphysics must be recognized in the division of the sciences, because it gives a perspective of reality not contingent upon the empiricism of the scientific method. More importantly, metaphysics allows the pursuit of answers to those questions that be approached by empiricism, e.g., What is the meaning of life?

According to Aquinas, natural science studies material things, but with the understanding that their substantial essences cannot be known.[50] The knowledge gained of natural things, therefore, comes "through their accidental characteristics—their quantity, qualities, operations, etc.—which are signs of their essential properties."[51] In other words, one learns about natural things through their sensible appearances. Modern natural science, though, no longer abides by this medieval understanding. Today's scientists have replaced a search for essence with a search for description. The search for the essence or quiddity of a thing was abandoned, because satisfaction was found in the application of characteristics to a thing, instead. With Aquinas, one admits that one does not know what an electron is, because its essential substance is not known; one can only seek to describe it, using its physical characteristics. Modern natural scientists have adopted the description of an electron, determined through the use of various methods of instrumentation, as the essential being of the electron: an electron is a measurement of energy or a direction of spin, etc. This, though, gives no further understanding of what an electron is, because a description is only the best metaphor language can give. It is not an insight into the quiddity of an electron.

Today's scientists have replaced a search for essence with a search for description. The search for the essence or quiddity of a thing was abandoned, because satisfaction was found in the application of characteristics to a thing, instead.

Where to go from here?

For Bacon, "all knowledge proceeds from a twofold source—either from divine inspiration or external sense."[52] Scientific knowledge is derived from nature and reason, whereas divinity is apprehended only through faith and revelation. This strict separation of science from divinity is known as the "Baconian compromise." Through his subsequent thought, in *Advancement of Learning*, this separation became further distinct through his formation of two books: the book of God's word, the Bible; and the book of God's works, nature or the physical world. James Moore describes the resulting separation this way:

> ...a political compromise offering illustrations of the divine omnipotence, the true sense of the scriptures, and recovery from the noetic effects of the Fall in exchange for the freedom of the students of nature from harassment by interpreters of biblical texts.[53]

The Baconian compromise allowed the young, budding field of modern natural science to begin the examination of nature, unimpeded by any possible contradictions present within the theological discipline. This compromise, subsequently, provided a means for rationalists to separate themselves from people of faith. Those who use reason to conceptualize reality argue that they no longer need to be hindered by the subjectivity found in faith's personal experience. But as John Paul II says,

> Reason and faith cannot be separated without diminishing the capacity of men and women to know themselves, the world and God in an appropriate way.[54]

This separation can be easily seen today, played out in the current lack of dialogue between scientists and theologians. Scientists contend the true perception of reality can only be through the objective scientific method; whereas, theologians assert that life has meaning beyond the realm of measurement. It should be realized that reason, deprived of faith and metaphysical considerations, takes "side-tracks which expose it to the danger of losing sight of its final goal."[55] Simultaneously, faith or metaphysics without reason stresses "feeling and experience, and so run the risk of no longer being a universal proposition."[56] A rediscovery of the pre-Baconian method is called for, the method that benefited from a reason/faith partnership, because "faith and reason...each without the other is impoverished and enfeebled."[57]

The reality offered by modern natural science's physico-mathematics must be understood to be limited to the physical world. This recognition means that the questions asked and the answers given by scientists are properly confined to this physical world. Hence, theoretical physicists and other speculative scientists do not have the right to speculate about anything that leads to a metaphysical conclusion. Today's scientists must also realize that the results of physico-mathematical science are not the totality of reality. Instead, physico-mathematics is a system of symbols that helps relate the measurements of nature coherently. And what happens in the study of a system that does not yield to physico-mathematical conclusions? Does modern natural science's concept of reality crumble? Thus, modern natural science's insistence that the physico-mathematical version of the physical world is reality appears ridiculous.

Finally, the fact needs to be appreciated that modern natural science no longer seeks to determine the essence of what it studies. It has long been completely satisfied with a description of an object rather than a determination of what it really is. For these reasons alone, modern natural science has no right to monopolize what truth or reality is and, furthermore, no right to discuss the metaphysical implications of the being or essence of something it does not truly know or even seek to know.

Metaphysics needs to be returned to its medieval role as "queen of the sciences." Since metaphysics deals with what is "beyond physics"—and consequently modern natural science—it should regulate the sciences to positions below it. A structure that maintains modern natural science as subordinate to metaphysics is not something to be feared or (more importantly) scoffed at by today's scientists. Modern natural scientists need to understand once again the importance of a metaphysical discipline that deals with what is beyond the contingency of measurement, because to deal with metaphysical ramifications within physical arguments, scientists imply that modern natural science is something it is not—namely, metaphysics.

Is it necessary, then, to choose between the reality offered by modern natural science and the reality of metaphysics? No, but a way must be discovered successfully to house their two concepts of reality under one system. This system is found within the thought of St. Thomas Aquinas. Maritain contends Thomistic philosophy is the most appropriate in giving the metaphysical framework within which physico-mathematical science can function.[58] He says that Thomistic philosophy is valuable, because it is "essentially realistic and gives a critical justification for the extramental reality of things and the value of our powers of knowing, which every science takes for granted...."[59] This philosophy is important also because it does not impinge on the autonomy of each science's method of finding truth.[60] Returning an ontological approach

to modern natural science would also restore science's original goal—solving the mysteries of God's creation. As John Paul II says,

> the search for truth, even when it concerns a finite reality of the world or of man, is never-ending, but always points beyond to something higher than the immediate object of study, to the questions which give access to Mystery.[61]

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Boethius and the Block Universe: Physical and Metaphysical Considerations of Time

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In this exploration of the nature of time, the author shows that more than a superficial belief in a creator God invites the person of faith to engage with some of the unsettling questions presented by modern physics and cosmology. He considers how human beings study and measure time, and he also treats how we experience time as creatures "caught" in its passage, and the emotions evoked by that experience. The various possible paths of the future of the universe are provocative subjects for theological treatment.

Introduction

Time was invented to stop everything from happening at once. Indeed, if it were not for the experienced properties of time, this talk would simultaneously begin and end, and we could all go home. Now there's a mercy! But time *is*—whatever it is—and the lecture must begin and end, an experience of duration, mingled with hope.

This presentation grew out of drawing graphs and thinking about Caroline, Princess of Wales. The graph part was completely straightforward, simply a matter of staring at something utterly commonplace in the life of scientists. On graphs, time is always the independent variable, and the horizontal axis is conventionally labelled as the time axis. I was staring at a graph of space versus time and thinking about the point of intersection of the x and y axes, a point called the origin, when the phrase, "God is here; Christ is now," came to mind, and this lecture began to take shape.

As for Caroline, Princess of Wales in the early years of the eighteenth century, her tenuous connection with this lecture arises because I recalled reading that she had received a letter from Gottfried Wilhelm Leibniz, co-inventor of the calculus. In his letter, Leibniz complained about the decline of natural religion in England: he blamed Newton for this. Caroline, who was intellectually equipped to take a lively interest in such matters, passed Leibniz's letter on to the Reverend Samuel Clarke, who defended Newton; and thus began the famous Leibniz-Clarke correspondence, which included an illuminating debate about time in classical physics—and provided the other starting point for this lecture.

The theological and metaphysical framework of the lecture is that of Christianity. Christianity, with its claims to be an historical religion, has always taken time seriously, that is, it has concerned itself with events in time and measured the life of this world from an unique event.

The life and death of Jesus of Nazareth happened during the prefecture of Pontius Pilate. Salvation History is measured against time. Thus, at its heart, a religion that came to say of God that God is Christlike and that *in* God is no *un-Christlikeness* at all poses for itself the problem posed of the relationship between God, time, and eternity. In his fine study, *The Future*, philosophy tutor at Merton College, Oxford, J. R. Lucas asserts that "reality is through and through temporal. Equally, God is temporal, though not

merely that."[1] And if we question this, Lucas reminds us that in Christianity, God is personal. And if God is personal, then temporal, and if temporal then in some sense *in* time, not *outside* it.

> Time is not a thing that God might or might not create, but a category, a necessary concomitant of the existence of a personal being, though not of a mathematical entity. This is not to say that time is an independent category, existing outside of God. It exists because of God: not merely because of some act of will on His part, but because of His nature: if the ultimate reality is personal, then it follows that time must exist. God did not make time, but time stems from God.[2]

With respect to time, is it possible actually to know whether one is dealing with factual certainties (to know, that is, in the traditional philosophical sense of a justified true belief) or uttering a "merely subjective" statement about one's psychological condition? St. Augustine of Hippo wrote, "Time is a dimension of the soul, not of the outer world."[3] In a complementary view, Hermann Weyl asserted,

> The objective world simply is; it does not happen. Only to the gaze of my consciousness, crawling upward along the life line (world line) of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time.[4]

Whether the sources of our ideas about time lie in the phenomenal world or are artifacts of consciousness, there are interesting insights about the atemporalities of the unconscious mind that might affect our notions of eternity.

God, too, is held traditionally to be incomprehensible: the concept encoded by the term *God* is elusive and our images are inadequate or possibly quite misleading. Can one know that any predicates apply unequivocally to God—not least, slippery predicates such as *eternal*? Tillich thought one ought to be at least very wary here. Fools rush in...or, perhaps, we should stop now. We were encouraged by Augustine to speak something about God rather than nothing. After the lecture, you might think nothing would have been preferable.

Measuring time and the shape of time

With respect to time, is it possible actually to know whether one is dealing with factual certainties (to know, that is, in the traditional philosophical sense of a justified true belief) or uttering a "merely subjective" statement about one's psychological condition?

Like Judaism, and unlike many animistic religions, Christianity held, and holds, a linear rather than a cyclic model of history. History, the theater of the operations of God among human societies, is going somewhere. Time has direction.

And it can be argued that monastic Christianity, with its desire to sanctify all the hours of the day through the regular progression of the offices of the Church (lauds, matins and so on), provided the impetus for the more accurate measurement of time by means other than the irregular patterns of nature, of the rising and setting of the sun, for instance, or the annual return of the seasons—in other words, by astronomy. The local solar clock doesn't operate in nice, neat, whole numbers: the Earth Year in the year 2000 will be 365 days, 5 hours, 48 minutes, and 45 seconds long. But we mustn't count on that lasting. On average, the sidereal year (time taken for the earth to orbit the sun or rotate around a common centre of gravity with the sun) becomes less by half a second per century. Since

1972, thank goodness, Atomic Time replaced wobbly Earth Time (in units of the regular oscillations of cesium atoms, 290,091,200,500,000,000 of them make up a year).

Our calendars are cyclic: February recurs annually, Friday occurs weekly. The years change in a linear way. A.D. occurs after B.C.—OR C.E. occurs after B.C.E. I have heard it argued that time is a Christian matter, and in the year 2000 (or possibly 2001), Christians will celebrate the bimillennium of Christ's birth, and that proves that time a Christian matter.

Against this, one could point out that the names of the months and days in the West are pretty thoroughly pagan: Augustus, Thor, Julius, Freya, the day of the Moon and the Sun. All these are more frequently on our commemorating lips that A.D. or C.E.

Chronos *time and* kairos *time*

Greek has two words for time, *chronos* and *kairos*. *Chronos* time is measured time; it has duration, can be cut up into measurable increments down to nanoseconds and beyond, and is, in this sense, decoupled from astronomy.

Apart from astronomical reference, how cultures traditionally measure *chronos* time is very variable. For instance, in villages in rural India, before the arrival of digital watches, the shortest time interval that could be meaningfully discussed was the time taken to boil rice, about thirteen minutes.

In the West, *chronos* time came to be measured by reference to increasingly sophisticated technological means, external to the person. Candle clocks, water clocks, mechanical clocks (some of great beauty such as the mediaeval clock in Wells Cathedral in England)—all such devices divided time into units not derived from observable astronomical events. The search for more and more precise ways to measure time is a central feature of the history of science and technology. Some here may have read Dava Sobel's book, *Longitude*, that most interesting account of the development of accurate navigation, made possible by improved chronometry. New Age writers critical of the rise of Western science have argued that the obsession with more and more accurate chronometry has had an unfortunate effect of distancing the human chronometrer from the processes of the natural world.

Kairos time is different: *kairos* is significant time, meaningful time. Years are not experienced as sequences of equal intervals of measured time. Rather, we celebrate Easter and Christmas, birthdays and anniversaries, beginnings and ends of academic terms, all very non-homogeneous in experience. When a child is at play or a student is waiting for an exam, or when a person is in love or waiting to go into combat, time is not *chronos*: it is *kairos*. The catholic Church year is mapped by *chronos* but experienced as *kairos*. Lent, for instance, lasts forty days (and forty nights), and is, therefore, *chronos*. But it is also a penitential season, when we are to "smite the hosts of mydion" by holy fasting, abstinence, and inspissated gloom. So, we apply somber purple liturgical vestments to priest and altar, to remind us of the *kairos*, the experiential aspect of the season.

The problem for theologians

Our understanding of time has changed from the commonsensical, pre-scientific view to the Newtonian view; and it has changed again, in the light of relativity and quantum theory. Do such changes in our concept of time affect what we believe about God and God's relationship to the universe? Do they make it easier or more difficult to appropriate traditional formulations of the doctrines of God?

The answer most people would give, if asked about such issues—and they'd be in good company—would be "I'm not sure." They are confused. Well, it is a maxim of great truth that education is a process in which one begins by being confused and winds up by being confused at a higher level. So it may be tonight!

St. Augustine famously remarked that if he wasn't actually asked the question, "What is time?", he knew well enough what time was, but that upon being asked that question, he found that he didn't know.

And Aristotle before him noted uncomfortably that

> [o]ne part of [time] has been and is not, while the other is going to be and is not yet. Yet time—both infinite time and any time you like to take—is made up of these. One would naturally suppose that what is made up of things which do not exist could have no share of reality.[5]

Everything that we value, cherish, or fear has either vanished forever or not yet arrived. All we have is the infinitesimal fragment of the now, and even that vanishes, as soon as we try to lay hands on it. But I'll have more to say shortly about the present moment.

Other philosophers have agreed with Aristotle. For example, the idealist philosopher, J. M. E. McTaggart, argued in a classic paper that the temporal order is impossible, since every event in it would have to be simultaneously past, present and future; and these predicates are directly self-contradictory. That is, time is unintelligible without the concept *now*, and *now* is contradictory. A way around this is to say there is no past nor future, only *before* and *after*—relative in time, relative to one another with no moment privileged as *now*. *Now* would be a concept like *this* or *I*, expressing the point of view of the speaker, but not features of the world. Of course, if time itself were cyclic, then past and future would have no meaning, because the remote past would also be the remote future, and we could affect the past. And yet, and yet....

No wonder Augustine found his grip on what he thought he knew slipping. Let me quote a few words from McTaggart's famous chapter on time in his book, *The Nature of Existence*:

> It seems highly paradoxical to assert that time is unreal, and that all statements which involve its reality are erroneous. Such a statement involves a departure from the natural position of mankind which is far greater than that involved in the assertion of the unreality of space or the unreality of matter. For in each man's experience there is a part—his own states as known to him by introspection—which does not appear to be spatial or material. But we have no experience which does not appear to be temporal. Even our judgements that time is unreal appear to be themselves in time....[6]

McTaggart then points out that

> in all ages and in all parts of the world the belief in the unreality of time has shown itself to be singularly persistent. In the philosophy and religion of the West—and still more, I suppose, in the philosophy and religion of the East—we find the doctrine of the unreality of time continually recurring. Neither philosophy nor religion ever hold themselves apart from mysticism for any long period and almost all mysticism denies the reality of time.[7]

A few years ago, Kitty Muggeridge translated de Caussade's spiritual classic *Self-Abandonment to Divine Providence*. De Caussade (d. 1751) was, as you may know, a Jesuit priest and spiritual director to a convent. As a title for her translation, Muggeridge chose *The Sacrament of the Present Moment*. This idea of being in the presence of God only in the present moment is central to Benedictine spirituality, too. And from the Orthodox tradition, it seems good to remember Lossky's *Mystical Theology of the Eastern Church* and Schmemann's *The World as Sacrament*. We have only the *now*, however elusive that may be, in which to meet God. And yet....

Incarnational theology must take time seriously, just as it takes matter seriously. The assertion that mysticism denies the reality of time runs counter to incarnational and sacramental theology. Whatever mystics claim to experience of being outside time in some mystical union with God (sometimes described as "self-forgetting"), nevertheless, we are all, always, human organisms; creatures who must move into God's future at one second per second.

We never stand still in time, nor can we "save" time, nor "spend" time, nor "kill" time: we must always be pilgrims, moving on. We are inevitably, inescapably, directed toward the future. I have often thought about this aspect of our created nature and wondered at the Church's obsession with the past. If the world of space-time is sacrament and we are created such that we are constantly propelled into the future at one second per second, perhaps God is expressing something of the divine loving purpose for us through time. The breeze blowing in our face carries a freshness from God's future, but we look backwards into dust. What spiritual significance has our refusal to face forward, to acknowledge our orientation in time? Of course, an important aspect of human and institutional life is our memory of the past. (We do not remember the future.) Memory may be important, but it is not where hope lies. Hope is a forward-directed theological virtue.

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In all theological speculation about the way the world is (or appears to be), I find myself agreeing with my predecessor as Warden of the Society of Ordained scientists, Arthur Peacocke, when he said,

> While we need not expect to read off directly from nature properties of the Deity, as it were, nevertheless, it would seem odd if there were nothing to be inferred of the Creator from the properties of the creation.[8]

Or, as the poet Robert Browning put it in his poem, "Fra Lippo Lippi":

> This world's no blot for us, nor blank: It means intensely and it means good. To find its meaning is my meat and drink.[9]

Now

Let me come back, for a moment, to the phrase, "God is here, Christ is now." Attending to God now, being centered in awareness of one's place in the present moment, isn't just good spiritual advice: it is our only option. We cannot meet God in the future nor in the past, nor ought we to console our time-bound selves by trafficking in spatial imagery.

The commonsensical view of time assumed by the theology of previous centuries seemed to be supported by classical physics. The present moment exists, the past has ceased to exist, the future does not yet exist: the metaphysical basis of the theories of classical physics appears to eliminate time altogether as an aspect of the world. Physical processes are independent of time and hence reversible. In a memorable phrase, Ilya Prigogine described this as "the exorcism of time."[10] Thus, classical dynamics observed its world of quantifiable spatial extension, the *res extensa*, from the timeless perspective of a god, from eternity. Eternity was abstracted from this worldview: it was either timelessness or an unchanging present. And this was the notion of time and eternity one finds, for example, in the theology of Boethius:

> Embracing the infinite lengths of past and future, it [God's knowledge] considers everything as if it were going on now in a simple mode of awareness. So, if you want to weigh the presentness with which he discerns everything, you will more rightly judge it to be not a foreknowledge as of the future, but the knowledge of a never failing instant.[11]

James Clerk Maxwell highlighted the distinction between the reversible mechanical laws of classical physics and the essentially irreversible natural processes described by the second law of thermodynamics. In a letter to Mark Pattison, in April 1868, Maxwell wrote,

> if every motion great and small were accurately reversed, and the world left to itself again, everything would happen backwards the fresh water would collect out of the sea and run up the rivers and finally fly up into the sky in drops which would extract heat from the air and evaporate and afterwards in condensing would shoot out rays of light to the sun and so on. Of course all living things would regrade from the grave to the cradle and we should have a memory of the future but not of the past. The reason why we do not expect anything of this kind to take place at any time is our experience of irreversible processes, all of one kind, and this leads to the doctrine of a beginning and an end instead of a cyclical progression for ever.[12]

Thermodynamics in the nineteenth century and relativity in the twentieth century reintroduced time into physical theory, but not necessarily in a way easy to accommodate with traditional theological writings. In Newton's world, any observers could agree that two events had occurred simultaneously. Albert Einstein theorized that if one observer were moving relative to another, they could not agree that two events were simultaneous: there could be no universal present moment in a universe that is a succession of instantaneous spaces. Einstein's special and general relativity use a single geometry to describe Minkowskian "space-time." But relativistic physics only uses concepts such as *before* and *after*, not *past*, *present*, *future*, or *now*. The geometry of space-time disturbingly omits our experience of the present moment. How might the absence of the concept *now* from the scientific description of the world in relativistic physics matter for theological discourse and the religious life in which it is such an utterly pivotal idea?

A pivotal idea, indeed. But what is *now*? A concept much more problematical than *here*. Centering oneself in space in preparation for prayer is relatively straightforward, compared to understanding oneself now. "I am in this room, at this desk, preparing to pray...at this moment, preparing to place myself consciously before God, now...now...now."

But even here, modern science undermines or supersedes the commonsensical view of the present moment being, as it were, an instantaneous cusp, the crest of the standing wave in the flow of time from the future into the past.

I have in mind Miroslav Holub's essay in *The Dimension of the Present Moment*. If the present moment is where we must meet God, then there are some surprises from experimental psychology:

> The fact that I cannot imagine the present moment has always worried me. By the present moment I mean a conscious individual state or process, an experience; the larger scale moment is easier to grasp. What is a moment, what is this moment in which I evidently exist, unlike nature, which according to Whitehead's famous quotation does not exist in a moment? As a matter of fact, I can imagine eternity much better, particularly when looking up at the sky or the ceiling of a waiting room.... For me, the present moment has always been a dimension without a dimension.... I have finally found satisfaction in recent data of experimental psychology. The present moment lasts three seconds. In our consciousness, the present moment lasts about three seconds, with small individual differences.[13]

Time as space

In thinking about time, it is natural to picture it in spatial and, therefore, misleading terms. Time is a river into which one can never step twice. As in the Isaac Watts hymn, "Time, like an ever-rolling stream, bears all its sons away"[14]—daughters, too. Time is an arrow in another metaphor, an arrow with no target, coming from nowhere. *Now* is the cusp of the standing wave in the stream, with the future sweeping up toward it and the past sliding away behind. Is that your picture? Or is *now* the point of the ar-

row? Both spatial images. Such spatial imagery possesses our imaginations; but I don't know how far we increase our understanding of time, if that is possible at all, when what we are doing is comparing time to a process occurring in time. There seems something circular in trying to get a grip on time in this way. Nevertheless, because we remember the past but not the future and seem surrounded by one-way processes, these spatial images seem true to experience. An approach to Einstein's relativity sees time as analogous to space. The entire ensemble of events, past, present, and future, is equally real, equally actual in a static, block universe. Our perception of time, of happening and change, in this interpretation, is merely the product of human psychology, as in the quote from Weyl earlier: "The objective world simply is." Or as Paul Davies wrote in *God and the New Physics*,

> [Relativity] does not regard time as a sequence of events which happen. Instead, all of past and future are simply there, and time extends in either direction from any given moment in much the same way as space stretches away from any particular place.[15]

Time, then, does not bear all its sons and daughters away like a rolling stream: they are still "there," only in an inaccessible spatio-temporal location. The future exists: it's there on the map already. We will encounter it, when we reach the right spatio-temporal coordinates. One would think that Boethius' God, experiencing all moments simultaneously, would fit such a view. One would think also that such a deterministic interpretation would eliminate human free will and, therefore, all moral praise and blame. The past has not caused the present: what one does now will not change the future, because the future exists already. This is not, as Christians have supposed and have written into their theology, a universe of being and becoming. There are non-deterministic interpretations that deny the picture I have described. Professors Chris Isham and John Polkinghorne have written up an exciting, not unduly technically demanding, unresolved debate on these issues, to which I draw your attention and to which I am indebted.[16]

Of course, an important aspect of human and institutional life is our memory of the past. (We do not remember the future.) Memory may be important, but it is not where hope lies. Hope is a forward-directed theological virtue.

In modern physics, the time dimension of space-time has different properties from the space dimensions. These properties are worth noticing, because they throw some light on what's wrong with spatial images.

For one thing, time has direction: that is, it always moves from future to past—or rather, it's not so much that time has a direction, but that things *move* in time. Nothing moves backwards in time. The possibility of moral action depends on this truth. Even though some physical processes or the mathematical descriptions of them are not directional, time itself is. Modern physics also states that, if a process is physically possible, so is the same process run backwards. Physical processes are "symmetrical" in this way. So why is it that, at the level of causal observation, the world is temporally asymmetrical?

Secondly, we can move at varying speeds through space, but not through time. As a hot-rod kid, I once drove my Dad's Buick Riviera at 120 mph in a 30 mph zone. Big mistake legally, though very gratifying emotionally, at that moment. But one cannot accelerate through time: one is swept

into the future at a constant 1 second per second. Acceleration up to 2 seconds per second, so as to overtake your business rivals, is impossible, as is the desire to slow down to half-speed. As Faustus pleaded, quoting Ovid:

> *O lente, lente currite noctis equi*: the stars move still, time runs, the clock will strike, the devil will come and Faustus must be damn'd.[17]

Recall that Ovid wanted more time in the arms of his mistress, while Faustus was being swept inexorably to his doom

The uncommonsensical description of time in relativity carries with it theological implications, if theology assumes a universal invariant time unaffected by gravity or velocity.

Thirdly, everything in time occupies all the time during which it exists. Nothing in time excludes anything else. With space, it is different. If I, a solid object, am in this space, you are not—unless you push me out of your way. But time isn't like that: we cannot speak of a position in time in the same way as a position in space, which we can change.

The second law of thermodynamics and the human tragedy

The mystery of meeting the love of God in prayer is bound up in the mystery of who we are, and who we are is bound up in our experience and understanding of time. But our understanding of time is emotionally loaded by entropy: this is *kairos* time. The Oxford physical chemist and evangelist for atheism, Peter Atkins, makes great play of the view that the irreversible, purposeless exploration of the geometry of time is what the second law of thermodynamics is all about. Atkins has no doubt that time is theologically significant, because, as he pointed out on the BBC just this week, the processes increasing the entropy of the universe reveal futility in believing in a good God with purposes for the creation. Entropy, an utterly temporal phenomenon, is a temporal argument for asserting that there is no God. I think Atkins is wrong. Long before Clausius or Lord Kelvin described entropy in terms of heat transfer down a thermal gradient or the inefficiency of the conversion of heat energy to work, everyone knew what the *kairos* of entropy change was about.

All human beings, even Peter Atkins, live in the present, sometimes dominated by real or imaginary memories of the past, sometimes hopeful, sometimes terrified by the future. Poets were there before the thermodynamicists and wrote of the universal human experience:

> Had we but world enough and time,
> This coyness, Lady, were no crime.
> We would sit down and think which way
> To walk and pass our love's long day.
> Thou by the Indian Ganges' side
> Shouldst rubies find: I by the tide
> Of Humber would complain. I would
> Love you ten years before the Flood
> And you should, if you please, refuse
> Till the conversion of the Jews.
> My vegetable love should grow
> Vaster than empires and more slow;
> A hundred years should go to praise
> Thine eyes and on thy forehead gaze;
> Two hundred to adore each breast;
> But thirty thousand to the rest;
> An age at least to every part,
> And the last age should show your heart;
> For, Lady, you deserve this state,
> Nor would I love at lower rate.
> But at my back I always hear
> Time's winged chariot hurrying near;
> And yonder all before us lie
> Deserts of vast eternity.[18]

This is the human condition and the constant refrain of poets:

> Gather ye rosebuds while ye may,
> Old Time is still a-flying:
> And this same flower that smiles today
> Tomorrow will be dying.[19]

This is the poetry of the second law of thermodynamics, of entropy, of the inevitable change and decay I see in all around.

> Go not gentle into that good night.
> Rage, rage against the dying of the light.[20]

This is part of the fallenness experienced by humanity? Is this what processes in time convey? Is this the necessary corollary to hope being a future-directed phenomenon?

One of the sharpest insights into how humans experience *kairos* time came to me from my pastoral care ministry, and it added a seriousness to my reflections. A severely depressed parishioner of mine, looking back on the depths of her despair, said that the worst bit about being in that dark state was her constant terror that the next second hadn't happened yet. Think about that. That human condition of being embedded in time felt for my parishioner like an eternity. And her experience, far from rare among us, makes the mystics' denial of the reality of time and block-universe speculation of atemporality seem cheap. It marks the locus of the seriousness with which Christianity treats time.

You will appreciate that this time-bound human condition gives some of the emotional power to one of the doctrines of Christian faith: the hope of salvation from the iron gates of time that open into the grave.

Infinity and the Unconscious Mind

Experiences of transcendence very often have a timeless quality: indeed, the sensation of time having stopped, of being somehow "outside time" is almost a defining quality of such experience. The "still point of the turning world" is T. S. Eliot's point of meeting with the eternal God.[21] If Christianity has been attracted to the physical sciences in its quest to articulate its attempts to understand the relationship between the divine and the temporal, there are insights in the recent work of depth psychologists to which attention might also usefully be directed. I allude only fleetingly to the work of the Chilean psychoanalyst Ignacio Matte Blanco, a devout Roman Catholic. His *The Unconscious as Infinite Sets*, published in 1975, was followed in 1988 by *Thinking, Feeling and Being.* [22] In these books he explored the logic of the Unconscious, in which the converse of any relation is treated as identical with the relation: that is, temporally asymmetric relations are treated as if they are symmetrical. The effect on our experience of time is clear: he suggests that the extent to which symmetric logic is present is symmetric logic is present is a measure of the influence of the Unconscious mind. If one event is before another in time, to the Unconscious the first is also after the second. In symmetric logic, "A is before B" implies that "B is before A," and from this it follows that all time is simultaneously present to the Unconscious mind. Clinical experience of the Unconscious demonstrates that it possesses the properties of the eternal as Boethius understood it. To what extent, if any, is the Unconscious the root of the mystics' experience of the timeless aspect of God? As Eliot says in "The Four Quartets,"

> Words, after speech, reach
> Into the silence. Only by the form, the pattern,
> Can words or music reach
> The stillness, as a Chinese jar still
> Moves perpetually in its stillness,
> Not the stillness of the violin, while the note lasts.
> Not that only, but the co-existence,
> Or say that the end precedes the beginning,
> And the end and the beginning were always there
> Before the beginning and after the end.
> And all is always now.[23]

This internal psychological aspect of the experience of the eternal Holy merits much more attention than can be devoted to it now, but it is worth asking what the relationship of the laws of physics we construct or construe to the Unconscious might be.

The nature of space-time

We no longer think in terms of absolute time: we know that time is intimately bound up in the nature of the universe in a sort of "trinitarian structure" of space, time, and matter, and that these interact.

The debate in which Caroline, Princess of Wales, interested herself was between Leibniz's view that time is nothing over and above an observable ordered system of events and that space is nothing over and above an observable system of bodies, and Newton's view in which space and time have an existence independent of events and bodies, and are God's *sensorium*—aspects of God. That's the "container theory," and it has occupied a strong place in theology since Newton. In Leibniz, space and time are not "things" in their own right: they are merely a way of describing the relationships between events.

The other view that Newton held was that, in order to deal with our experience of events and objects—our *experience* (*nota bene*)—we posit the existence of space and time, each with a certain structure. We can't directly observe the properties of space and time; the structures emerge in the process of inference to the best explanation, as we construct physical theories. So, we could have time according to either of Newton's theories—that is, even if there were no events, we could still speak intelligibly about time in any way consistent with our experience of events, either *kairos* or *chronos*.

The Oxford philosopher of science, Bill Newton-Smith, proposes that one could replace space and time with space-time, and it wouldn't affect this debate.[24] General relativity is neutral about the outcome of the debate. This, then, remains an open question, with theological implications still to be drawn out.

Relativity, quantum theory, cosmology, and eschatology

The uncommonsensical description of time in relativity carries with it theological implications, if theology assumes a universal invariant time unaffected by gravity or velocity. Massive objects—objects that have great mass—such as the earth or the sun or Black Holes, curve space-time to an observable degree. Gravity is thought of a geometrical property of space-time. It affects space and it affects time. Newton' Law of Universal Gravitation predicts that the gravitational attraction on an object becomes less at higher altitudes from the earth. The further out from the surface of the earth a spacecraft goes, the weaker the gravitational field. The closer to the earth's surface we go, the stronger gravity is, the more sharply space-time is curved or warped: the stronger the gravitational field, the greater the time-warp. According to the Theory of Relativity, gravity affects time. The weaker the gravitational field, the faster time flies: the lives of airline pilots—or even the men and women in the philosophy department up on the third floor here—are shortened relative to those who live on the ground. In fact, I have calculated that time moves more slowly at my feet than at my head by about 1×10^{-15} seconds per second. This effect has been noticed by my Oxford students, who agree that time *does* seem to move slowly at the feet of lecturers. And at the Schwartzschild radius of Black Holes, the curvature of space-time is so extreme that time stands still. It would seem, then, that the time we experience, and the time in which we construct theology, is not the constant, steady-stream, commonsensical picture.

And it turns out that time is also affected by how quickly a body is moving, as in the deathless limerick:

> There was a young lady named Bright
> Who travelled much faster than light.
> She set off one day
> In a relative way
> And returned the previous night.[25]

Experiments have been carried out with pairs of very accurate and robust clocks. They were started simultaneously, and one

was loaded onto a commercial airliner that set off to wherever it was going, and the other was left sitting in the laboratory. After some hours of flying, the clocks were compared. They gave different readings, the clock in the aircraft displaying an earlier time than the laboratory clock. This effect is called time dilation. At the sort of speeds we ordinarily attain, the effect isn't great; but the closer to the speed of light one travels, the greater the effect. At 10% of the speed of light, time is slowed by 0.5%. At 50% the speed of light, time is slowed by 15%; and at 90%, it is slowed by 30%. Scientists make use of this effect in particle research, by pushing particles along to only 1 kilometer per second less than the speed of light. Events happening so quickly that they could not ordinarily be detected become measurable under these extreme circumstances.

There are problems in the measurement of time itself, when one gets down to very small intervals, to quantum dimensions. Perhaps time, too, is discontinuous, quantized, and not a continuum, not a stream that bears all its sons and daughters away, but a burst of packets of "chronons."

What about the universe?

On the very largest scale, that of the universe, questions about time raise theological issues. In the 1920s, the American astronomer Edwin Hubble, after whom the Hubble Space Telescope is named, noticed that the light from distant galaxies is more red than expected. Inference to the best explanation led to an understanding of why the light from these faraway objects is shifted toward the red end of the spectrum: the galaxies, sources of light energy, are moving away from us (and from each other), and that the farther away they are, the faster away they are moving.

Because light moves at a fixed speed through empty space, it takes time for light to reach us from faraway objects. Light from the sun originated at the sun eight minutes before we see it. That is, as we look at the sun, we observe it as it was eight minutes in the past. As we observe the star next-nearest to the earth, Proxima Centauri, we see light that left that star four years ago. What we see when we look into a starlit sky is a chronicle of ancient starlight. We can never see the present, for that present moment for us is an artifact, utterly related to the unprivileged cosmological perspective from which we view the universe. Stars that we see twinkling in the night may have burned out or blown up in a supernova explosion before there was life on Earth, or before there *was* a planet Earth. There is a sense, then, in which we live in the past, and there is a sense in which all time is present at any moment.

While in prison and waiting to be taken out and bludgeoned to death, Boethius meditated on time and eternity in his* Consolation of Philosophy. *There he wrote his famous definition of eternity: "Eternity is the total and complete possession of unending life all at once."

The shape of things to come

And what of the future? Here is an aspect of space-time that has profound implications for eschatology, that branch of theology which deals with the end of all things, including time and space.

The universe in the current "standard model," Big Bang Theory, has a geometry: it is curved by gravity exerted by objects with

mass. If there is very little mass (on average just the equivalent of three hydrogen atoms per cubic meter) the curvature is described as "open" or "flat." In this case, the expanding universe Hubble described will go on expanding for ever, becoming colder and "thinner" in what is called the "Heat Death" of the universe.

If the average density is greater than three hydrogen atoms per cubic meter, then gravity wins, the expansion we now observe will slow to a stop and then the universe will collapse back in on itself, in a reverse of the Big Bang—a process poetically called the "Big Crunch." The result will be a state of enormous density at tremendous temperatures. Some speculate that the universe may be cyclic, going through an endless repetition of Bangs and Crunches; but as there could be no observational consequences of this for us, speculation it remains. The picture is something like an expanding and contracting heart, with the spores of life growing in the cool spaces between the stars during the expansion phase, then withering in the "autumnal collapse."

The theological implications of the end of the universe are bleak: in either geometry the universe in created to end in futility. It forces Christians to have faith in God alone, as the universe is not here to stay, not everlasting in any sense hospitable to life.

These aspects of the fate of the universe have been woven into a contemporary creation myth of great power and beauty, a myth which has inspired poets. John Fowles writes of,

> A phoenix infinity; or an infinite expansion. Whichever it is, the astrophysicists now know what Heraclitus guessed: that suns must grow in heat and finally consume their planetary systems. Look out of the window: everything you see is frozen fire in transit between fire and fire. Cities, equations, lovers, landscapes: all are hurtling towards the hydrogen crucible.[26]

Or, as the Christian poet Norman Nicholson expressed it in his poem, "The Expanding Universe,"

> The furthest stars recede
> Faster than the earth moves,
> Almost as fast as light;
> The infinite
> Adjusts itself to our need.
>
> For, far beyond the furthest, where
> Light is snatched backward, no
> Star leaves echo or shadow
> To prove it had ever been there.
>
> And if the universe
> Reversed and showed
> The colour of its money:
> If now unobservable light
> Flowed inward, and the skies snowed
> A blizzard of galaxies,
>
> The lens of night would burn
> Brighter than the focussed sun,
> And man turn blinded
> With white-hot darkness in his eyes.[27]

Here pressing in on us, fully engaging the imagination, is a myth of great power. Big Bang theory, the coming into being of space-time, the expansion of a universe, the explosion of supernovae and the scattering of the heavy atoms so that we might be, is more than a lifeless description from physics: it has about it the logic of human self-involvement. It becomes a myth about the meaning of our place in created time. But so too, does the end of all things. Can we theologize about this? Lutheran theologian Ted Peters plunges in:

> The end of the cosmos will be something new too. The question that remains is whether the anticipated heat death constitutes a sort of cosmic Good Friday, and whether it makes sense to hope that beyond it lies an Easter for the universe.[28]

The mystery of eternity

If science has made our understanding of time, already a difficult concept, even less intuitively obvious, what of eternity? However we understand it, eternity is not something like temporal everlastingness. Time, like space, is contingent—or as Christians want to say, time and space are "created" and held in being by God, for the divine purposes.

And what does Christianity teach? On which ideas about time, its reality and its

nature, are our doctrines based? On a time that has a reality apart from God? Or, rather, one that is utterly bound up in the created order? Time is not less a mystery now, but is time in modern physics congruent with our beliefs about God in a way that perhaps Newtonian absolute time was not?

I have referred often to Boethius (480-524 C.E.). While in prison and waiting to be taken out and bludgeoned to death, he meditated on time and eternity in his *Consolation of Philosophy*. There he wrote his famous definition of eternity: "Eternity is the total and complete possession of unending life all at once."[29] Boethius stood as a Christian in the Neoplatonist tradition. His was Plato's understanding of eternity, which remains attractive to many today: "time is the moving image of eternity," that is, time is real, but there is an unchanging, immutable, timeless realm that casts its shadow on the turning spheres below. Roger Scruton traces the power of its appeal:

> This vision was adapted to Roman stoicism by Cicero, to Christian devotion by St Augustine and to the pagan world of late antiquity by Plotinus.[30]

Aquinas and his successors approached the idea of eternity from mathematics, from the properties of number.[31] John Lucas, philosophy tutor at Merton College, Oxford, argues that we had better be careful of speaking about eternal God in this way, because it reduces God's personhood. And a God "standing outside time," as it were, seeing every moment at once, denies human freewill. Some models of eternity, constructed to accommodate ideas of God's foreknowledge, are like the concept of the block universe, in that what they seek to affirm about an eternal God's omniscience with respect to time entails denying the freedom we believe we experience as creatures in time, with an undetermined—or not entirely determined—future.

Anselm wrote in his *Proslogion*:

> You were not, therefore, yesterday, nor will you be tomorrow, but yesterday and today and tomorrow, you are. Indeed, you exist neither yesterday nor today nor tomorrow but are absolutely outside all time [*es extra omne tempus*] For yesterday and today and tomorrow are completely in time; however, you, though nothing can be without you, are nevertheless not in place or time but all things are in you, for nothing can contain you, but you contain all things.[32]

Can we never escape from spatial imagery for time, except by looking not outwards into the universe, but inwardly into the Unconscious mind? Is to do so to retreat into irrationality and give up on the centuries-long attempt to reconcile our theological models of God with our scientific models of the universe and their metaphysical bases? What is our relation with eternity as we stand precariously in the present moment and in a relationship with God? Where and what is that "point of intersection of the timeless with time" that T. S. Eliot described as the "occupation of the saint"?

Conclusion

Objective time is gone. It is gone in relativity, gone from the quantum world, gone in cosmology, where scales and redefinitions of time, real and imaginary, feel almost arbitrary. Only in a very reduced frame of reference do we still meet the idea of simple, linear, objective, absolute time. What we now see in physics is congruent with spirituality: we are immersed in time and timelessness, and we are in touch with eternity, as Boethius saw it.

Time performs the function of showing the limitations of description, of science, of language, and the limits of the universe. Like the rest of creation, time is sacramental—it points beyond the limits of the reality we have constructed around ourselves. Time does not stand still—at least, not for long—and as with so much else, the experience of time is more real than its explanation: this seems to me to be the character of sacramen-

tal reality: like all sacraments, time points beyond itself to God.

I close with a thought-provoking passage from the Gospel of Thomas. If the Canon does not allow us to claim this pericope as originating with Jesus, we might still find ourselves richer spiritually by reflecting upon it:

> The disciples said to Jesus, "Tell us, how will our end come?" Jesus said, "Have you found the beginning, then, that you are looking for the end? You see, the end will be where the beginning is. Congratulations to the one who stands at the beginning: that one will know the end and will not taste death."[33]

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3. Augustine, Book XI.
4. Weyl, p. 166.
5. Aristotle, IV.10.
6. McTaggart, "The Unreality of Time," pp. 23-24.
7. Ibid.
8. Peacocke, p. 46.
9. Browning, pp. 342-45.
10. Prigogine and Stengers, pp. 291-92.
11. Boethius, p. 5.
12. Maxwell, vol. 2, pp. 360-61.
13. Holub, p. 6.
14. Watts, verse 5.
15. Paul Davies, p. 26.
16. "The Debate Over the Block Universe," in Russell, Murphy, and Isham, pp. 139-147.
17. Marlowe, ii, 127.
18. "To His Coy Mistress," by Andrew Marvell, in Gardner, p. 334.
19. "To the Virgins, to Make Much of Time," by Robert Herrick, in Gardner, p. 243.
20. "Do Not Go Gentle into That Good Night," by Dylan Thomas, in Gardner, p. 942.
21. "Burnt Norton," in Eliot, p. 175.
22. See also *Unconscious Logic* by Eric Rayner (London: Routledge, 1995).
23. Eliot, p. 171.
24. See Newton-Smith.
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27. Nicholson, p. 54.
28. Peters, p. 292.
29. Boethius, vol. V, pp. 403-5.
30. Scruton, pp. 76-77. I recommend Scruton's book and also his essay, "Foreknowledge and the Vulnerability of God," and A. H. Armstrong's essay, "On Not Knowing Too Much about God," in *The Philosophy in Christianity*, edited by Godfrey Vesey (Cambridge; New York: Cambridge University Press, c1989).
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Chaos and Order in Nature/Creation: A Reading of Genesis 1-2:4a in Dialogue with Science and Philosophy

Jean H. Kim
Drew University

With inspiration from post-modern scientific theories (complexity theory, chaos theory, relativity theory, uncertainty theory, no-singularity/boundary theory), and from philosophical understandings of nature (ecstatic naturalism and Taoism), the author offers an innovative reading of the Genesis creation stories, focusing on the concepts of order and chaos. While criticizing the dichotomous dualism that underpins the human ordering system, she connects these rich meanings and wisdom signified by nature with theological discourse through a discussion of the infinity of God, the abjection of origin, the autonomy of creatures, and nature's complex and fluid manifestations.

The expanding universe: this is the place where discourse about the mystery of nature has its beginning in the language of science, philosophy, and religion. It is the place where nature becomes subject, object, and metaphor. The universe, however, does not fully reveal itself to human query and longing for its depths and boundaries, because as the universe expands, the unfathomable abyss also expands its elusive scope and enfolding. Nature's boundless womb is the locus where everything originates and evolves while its products stay within the gravity of nature. The sustenance of life, from a human perspective, is a manifestation of nature's grace. But humans also view nature as manifesting negative aspects, which have been interpreted as chaotic and demonic. Therefore, the long history of a battle between order and chaos has emerged in discourses focusing on binary aspects of nature. But is nature's bipolarity the only possible representation? Should nature be confined within an anthropocentric interpretation and signification? Are there any alternatives that would shatter this underlying dualism?

Despite nature's protean and complex manifestations, the dualistic understanding of nature has overwhelmingly enveloped Western discourse. Nature has often been disdained as a domain of "mere matter" displaying decay, corruption, and even evil, in contrast to the transcendental, divine, spiritual realm of no-nature, beyond-nature, or nothingness. Nature has been plunged into a fissure that wedges its complexity, ubiquity, creativity, and fecundity into a unified, determined, non-dynamic system of equilibrium. This creates a paradigm of antagonistic dualism in which the domination of order over chaos strains our entire understanding of the whole picture of the universe. Is this strained and unbalanced picture a sheer fabrication of human psychology that abjects our spawning ground, although a longing for a lost origin is not completely eliminated in it? Or, is it nature itself that is exhibiting a striking providence, which then anchors to the shore of religion? Can a scientific probe of nature eradicate a religious embellishment of nature as a dichotomy of chaos and order?

With regard to these questions, I would like to read Genesis 1-2:4a in the contexts of post-modern scientific theories, ecstatic naturalism, and philosophical Taoism. I believe the implication of these scientific and metaphysical cosmologies for the reading of

Genesis can germinate better interpretations by which to envision a more hopeful relationship between God and the whole creation. What is meant by the significations of order and chaos in these cosmologies, therefore, transforms interpretations by agitating the boundaries of theological dogmatism and adding richer meanings for understanding nature/creation.

In the beginning...

In the classical Christian doctrine of creation, the concepts of time and space are entwined with notions of order and chaos. Since the idea of linear time, and the related idea that an omnipotent, infinite God created finitude at a definite moment in time, are crucial aspects of the traditional doctrine of creation, the biblical phrase, "in the beginning," has understandably been loaded with interpretations not true to its original Hebrew meaning. According to the doctrine of *creatio ex nihilo*, there were no time and space before God's creation. Beliefs about God's infinity and absolute power have become convolved with the linear time concept that presumes a chronological beginning and end to the finite. Finitude appears bounded in its processes of decay, decline, and death, all of which must be transcended through humanity's relationship with God. In this paradigm, comprehending the order of creation is an assurance to humans that the omnipotent God will conquer chaos, freeing us from our imprisonment in finitude.

Absolute nothingness resonates with the "singularity theorem" that assumes "a point of infinite density and infinite curvature of space-time;" thus, time begins only at the big bang.[1] But what if the universe has no singularity, as Stephen Hawking argues? Hawking refuses the idea of a singularity, claiming another view in which "the universe would be completely self-contained and not affected by anything outside itself;" thus, "it would neither be created nor destroyed," but "it would just be."[2] This theory negates the idea of *ex nihilo* while also blurring the linear sequence of chaos to order. Hawking's "no boundary" theory explains the continual increase of disorder in the same direction of time as that in which the universe expands. He shows how the "three arrows" of time dissolve the deterministic and mechanistic relation of time and order.

> [The three arrows of time] are the thermodynamic arrow, the direction of time in which disorder increases; the psychological arrow, the direction of time in which we remember the past and not the future; and the cosmological arrow, the direction of time in which the universe expands rather than contracts.... The no boundary proposal for the universe predicts the existence of a well-defined thermodynamic arrow of time because the universe must start off in a smooth and ordered state. And the reason we observe this thermodynamic arrow to agree with the cosmological arrow is that intelligent beings can exist only in the expanding phase.[3]

In the expanding universe, therefore, order and chaos are not split in the sense that they are increasing in opposite directions of time.

Relativity theory shatters the notion of absolute time, as there are different measures of time depending upon the observers' relative state of motion or velocity. The idea of fixed time is meaningless since time has its dynamic interrelation with space in which the curvature of space and time is flexible and complex. The problematic idea about time and space in the traditional doctrine of creation is that time and order are viewed as parallel to divine characteristics, while space and chaos are viewed as parallel to creaturely manifestations. Time and order, thus, take superior images over space and chaos. This kind of thinking builds a hierarchical and dichotomous dualism that undermines the dynamic interactions of space-time and chaos-order. In that way, the understanding of the universe loses its luminous blaze radiated from nature's

beauty. The innumerable interdynamics of cosmic processes are, however, the locus of God's interaction with the world. There is chaos, spawning potentiality, and maternal gestation from which creation emerges. The birthing processes of nature in innumerable modes of fecundity still create nuclei, electrons, stars, molecules, plants, animals, etc. The expanding universe, in a "large-scale map-making," is isotropic and homogeneous, and that would presume cosmic order, if order means stability and smoothness.. But does chaos completely disappear into order?

Chaos/order

The dogma of *creatio ex nihilo* rejects the preexistence of chaos. The substitution of chaos with absolute nothingness is woven into the omnipotent image of God; however, this contradicts the Hebrew Scripture, which portrays repeated battles between God and chaos. The first word of Genesis, *bereshit*, is the construct-form in Hebrew grammar, not the absolute form, which suggests the preexistence of chaos, *tĕhōm*.[4] *Tĕhōm*—abyss, deep, ocean, the primordial waters—is an indispensable catalyst for the burgeoning of creation. If *ex nihilo* eliminates chaos—and there are many biblical sources that demonize chaos—then this demonization inevitably requires the birth of a heroic warrior God to have battle with chaos, as, for example in the story of the sea monster Leviathan.[5] The conquest of chaos is not a once-and-for-all-time battle, but rather a constant struggle, alluding to nature's ceaseless cycles. Does this mean that nature is the evil chaos that must be conquered or at least controlled by God for the sake of humanity?

The tutelary image of God intrudes into the trajectory of a human limit. The imagery of this elliptical orbit of God held by the gravity of the human world collides with the integrative relationship of God and the whole creation. If nature is seen as an evil power that threatens human life, then where does God's blessing upon the whole of creation fit? And how can the omnipotence of God allow the evil power to exist, considering it pre-excludes the creation of evil? Although chaos indicates the formless and the pre-spatial, it still illuminates a spatial image since it is not nothingness, but a potentiality that has not yet been actualized. Chaos and space are, thus, mingled images that have been disdained in much theological discourse, especially through a kind of negative feminization. The materiality of the primordial chaos is the spawning potentiality from which creation is unfolded. Thus, this womb-like chaos connotes the mammalian birthing process. Why, then, does chaos evoke an evil image, tainted with sinful corruption? Is there a cryptic code hidden in human psychology that causes us to fear the unfathomable depth, the primordial *hystera*, the lost origin?

Chaos and space are mingled images that have been disdained in much theological discourse, especially through a kind of negative feminization. The materiality of the primordial chaos is the spawning potentiality from which creation is unfolded.

The philosophical perspective of ecstatic naturalism links the abject unconscious of the self with the unconscious of nature. In this connection of depth psychology with semiotic ontology, Robert S. Corrington proposes that "the unconscious is the primary means by and through which the sign-using self becomes open to the heart of nature in its self-fissuring."[6] According to him, just as the self has a cleft from which an ontological wound/difference emerges, so too

nature is split into *nature naturing*—the potencies of nature (or nature creating nature), and *nature natured*—the emerging orders of nature. *Nature naturing* consists of pretemporal/prespatial potencies from which all forms of signification emerge into semiotic orders. The transitional process of nature, from potencies to orders, is analogous with the human "selving process" that denies and fears maternal chaos:

> Finite human consciousness stands to its own unconscious in the same way that *nature natured* stands to *nature naturing*. In both cases primal chaos is conquered so that an ordered (or at least partially ordered) domain can emerge and prevail against that very chaos. For finite consciousness to survive and emerge intact from the waters of the maternal it must push away its spawning ground and see it as a devouring threat. To return to the unconscious (qua birthing ground) would be to lose all light and all order, to be dismembered by the uncanny power that lies in the whence.[7]

So, a parallel abjection may be seen in human psychology, which is a fear of nature's ubiquitous phenomena that are incomprehensible, uncertain, non-deterministic, turbulent, and paradoxical. Yet it is nature that manifests all those ambiguous and complex interminglings of order and chaos. Those complexities, moreover, are where/how life evolves. This can be imagined as the *rūah* hovering over *tĕhōm*.

When life evolves...

The ceaseless movement of nature in its life process is complex and chaotic. Although the classical worldview posits nature in determinist, mechanist, and reductionist modes, the truth is that there are many uncertain or indeterminate traits in nature. Quantum mechanics discloses the discontinuous processes of microcosms. Werner Heisenberg's uncertainty principle represents the uncertainty of the position and velocity of an individual particle and only the probabilities of possible outcomes. It suggests the randomness and unpredictability of nature, which are often experienced in the field of chemistry. The concept of chance, thus, signals a non-deterministic world. Giorgio Careri properly indicates this point:

> *[C]hance plays a decisive role in the choice of new structures*, by taking the system farther and farther away from equilibrium in an unpredictable direction. Thus the forced evolution of the system from one new structure to another must in part have a "historical" character because of the influence of the preceding situation, but it also has a "nondeterministic" character caused by the series of bifurcations it must come across. . . . This gives the system several alternative possibilities of evolution that cannot be predicted because each branch of bifurcation is selected at random at the moment of instability.[8]

The non-linear dynamics of nature are often hinted at in the turbulent parameters of "strange attractors." A strange attractor is not like a simple and limited motion of "fixed point attractor" and a "periodic attractor" that representing the behavior of movement that reaches to a rest state or repeats in a cyclic path in phase space. A strange attractor manifests much larger phase space that has infinite modes, infinite degrees of freedom, and infinite dimensions.[9] Turbulent chaos, however, does not refer to sheer disorder, but rather to the wholeness of an order that is too complex to be comprehended, as shown in the Mandelbrot's fractal shapes. According to chaos theory, the simple-appearing orders actually undergo multifarious bifurcations in vastly fluctuating processes which are far from exhibiting equilibrium.[10] To my understanding, this complex chaos is the maternal ground for creativity.

Does the hovering *rūah* over the *tĕhōm* connote a fluid movement inciting creation? If creative evolution requires movement, then the wind-like *rūah* is parallel to God's creative activity, from which it follows that it is not rigid mastery over chaos but ceaseless rhythmic spontaneity. As

Terence E. Fretheim states, this "involves a process of action and interaction with what has been created."[11] More significantly, "let" or "let there be," which preceeds the telling of each act of creation, symbolizes the possible flexibility of creation's own agency. Fretheim's commentary is convincing:

> God's speech reveals divine vulnerability, for God's speaking does not occur in isolation or function as command. The use of the jussive "let there be" leaves room for creaturely response.... God's way of speaking creation communicates with others, makes room for others, with the attendant risks. God no longer chooses to be alone.[12]

In this regard, creation can be conceived as the avatar (incarnation) of love. Despite the human attempt to sublimate God into the image of the transcendental master, the spiritual interaction with creation, as depicted in Genesis 1, manifests a divine love that respects creaturely freedom, these creatures having their own creative and complex agency.

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Stuart Kauffman's own version of complexity theory is valuable for envisioning creatures' autonomous dimensions. Kauffman proposes "complexity theory" to explain that the crystalizations of catalyzed reactions take place "at the edge of chaos."[13] He argues that the order arising at the edge of chaos is not an system at equilibrium; rather, it suggests an order "full of flexibility and surprise," which he calls "complexity."[14] The evolution of a life-system that displays order is the result of spontaneous self-organization, which occurs at what Kauffman calls the "phase transition." Additionally, he explains that life is constituted by a vast web of crystallizations, by which he means that life emerges collectively as a whole:

> Life is an emergent phenomenon arising as the molecular diversity of a prebiotic chemical system increases beyond a threshold of complexity. If true, then life is not located in the property of any single molecule—in the details—but is a collective property of systems of interacting molecules. Life, in this view, emerged whole and has always remained whole. Life, in this view, is not to be located in its parts, but in the collective emergent properties of the whole they create.[15]

The "phase transition"—the spontaneous interaction of chaos and order—is necessary for life's emerging process. And this evolution of life is augmented by its collective interactions as a whole.

This view is very congenial to the expression of "let...bring forth" in Genesis 1:20 and 1:24, which illuminate life's self-organization and its flexible processes in the open and dynamic field of creation. If "let there be" reflects a divine love that encourages creatures' autonomy, "let...bring forth" perhaps more specifically associates with the quickening process of life. With the patriarchal contempt for space and chaos in relation to matter and flux, it is interesting that "let...bring forth" is applied only to earth and water, which can be understood as the maternal grounds of life. The rigid reading of Genesis found in this patriarcal pragmatism is absurd in this case. The beauty of creation abides precisely in its unconstrained mobility, when it is attuned to the whole. God's rejoicing of *tob*, which means "good" and was expressed by God during the creation, refers to a core of divine love that signifies nonjudgmental gratification, and the final "very good" after the creation denotes that

creation ought to be comprehended as a whole. The controlling valuation of the physical world is incompatible with the lure of God. God's response and relation to creation cannot be constrained to the human order system. The blessing of God, "be fruitful and multiply and fill the earth," therefore, is not meant for the abundance of human economy, but for nature's enhancement. And this enhancement is truly possible only in open creativity with the fluidity of nature. Nature's ceaseless flux is the essential notion of philosophical Taoism.

What Taoism illuminates is that nature's binary aspects never create a splintering that distracts from the harmonious continuum of nature's deeper condition. Order and chaos are not opposite aspects of nature; rather, they imply the subtleness of the depth-harmony.

The "how" of nature

In Taoism, the "how" of nature is the "how" of Tao. Taoism posits nature's spontaneity and the dynamic interactions at its core. Although it recognizes the bipolarity of natural phenomena, Taoism does not simplify nature's ubiquity into the dichotomous dualism that connotes the hierarchical value judgment. Rather, it contemplates nature's recondite fusion and disclosure without differentiating its value. In Taoist cosmology, nature freely flows into the incompatible horizons of order and chaos without friction. What Taoism illuminates is that nature's binary aspects never create a splintering that distracts from the harmonious continuum of nature's deeper condition. Order and chaos are not opposite aspects of nature; rather, they imply the subtleness of the depth-harmony. Nature is Tao itself, and, at the same time, the manifestation of Tao from which everything flows is the way of Tao. Although the Tao signifies infinity, this should not be perceived as being identical to a notion of theistic infinity. Tao stays within nature, not beyond it. Tao is the ground of nature that mysteriously dwells within nature while at the same time exhibiting nature's potentiality and possibility in both orderly and chaotic manners. The inexhaustible abyss of nature is like an eternal void filled with infinite potentialities that sprout infinite worlds.

Tao, therefore, does not differentiate good and evil and does not try to overcome the chaotic and demonic aspects of nature. Tao is manifested in *yin-yang* dynamics, which consist of the movement of nature's polarity. Despite the opposite-symbolism of *yin* and *yang*, such as dark and light, passivity and activity, and female and male, what is signified is not separable substances, *yin-yang* rather than *yin* and *yang*. It is a notion of a complementarity, symbolizing a paradoxical, interrelational polarity. Life evolves by the interplay of *yin-yang* dynamics, which represents the reciprocal process by which the current of nature flows as ceaseless change. Change is the heart of nature, leading to constant creativity and transformation in order to achieve harmony. Harmony, nevertheless, is not a unified order fixed in a utopian idealization. The process of transformation does not have a teleological directionality; rather, it lets things be themselves, creative, and flowing continually without artificiality and coercion.

The Tao, however, does have a nurturing principle, which is well described in the *Tao Te Ching*:

> The Tao gives birth to all beings,
> nourishes them, maintains them,
> cares for them, comforts them, protects them,
> takes them back to itself,
> creating without possessing,
> acting without expecting,
> guiding without interfering.
> That is why love of the Tao
> is in the very nature of things.[16]

As this passage shows, nurturing is somewhat different from intentional protection, nurturing emerges from "letting be," since there is no sheer quintessence in nature, but boundless flux. Taoist cosmology, thus, leads one away from an initial portrayal of nature, however orderly or chaotic it may look, to a more vast understanding of nature. It does this by helping us to see the oscillations and transgressions of the boundaries of order and chaos.

As mentioned above, the "how" of nature in ecstatic naturalism is situated at a fundamental divide in nature. Nature is all there is, and obtains as the availability of orders, orders that have no location. Yet within nature "betweenness" relations obtains. The potencies of *nature naturing* are pretemporal powers, emerging into the complex intersections of the world of *nature natured*. The pretemporal is, thus, "in no sense the eternal, as the pretemporal domain has absolutely no awareness of the temporality of the foundlings of *nature natured*;" rather, it can be understood as "the not yet temporal."[17] On the other hand, the orders of the world are infinite, as nature is constituted by an infinite series of "signs" and "interpretants (new signs)," which are surrounded by open infinites. These open infinites are inexhaustible, since *nature natured* is the mobile space within which semiotic orders unfold. As the fissure between *nature naturing* and *nature natured* can be brought to human awareness through the unconscious, the sacred is ejected from *nature naturing* into the location of *nature natured*, carrying a fragment of the ultimate origin from *nature naturing* into the world of semiosis. Nature's sacred folds, says Corrington,

> have no collective integrity, nor do they embody a common teleological pattern [because] they are prior to the emergence of good and evil traits within the human order.[18]

The sacred is manifest in four ways: sacred folds, sacred intervals, the unruly ground, and providingness. "Sacred folds" are epiphanies of power within nature, representing an increase in semiotic scope and density. However, there is no "ultimate" sacred fold. "Sacred intervals" emerge from the fissure of divided nature, they surround intense semiotic fields by encountering the sacred folds as an equal vector-force to dampen semiotic power. Therefore, if the folds emerge from a fragmented origin, the intervals move toward fragmented goals. The "unruly ground" is the non-located source for the world of orders; it is unconditional and incomprehensible in the depth of mystery.

> [It contains both] demonic and salvific seeds, [which provide] both actualities and possibilities, goods and absences, life and death, space/time and thing in space/time, infinitesimals and points, form and chaos, growth and decay, movement and stasis, meanings and surds, invitations and closures, and innumerable complexes for which humans have no categories, and presumably never will."[19]

Finally, there is "providingness" that is always present within nature, but not as a conscious agent to sustain human desire.

Nature, for both Taoism and ecstatic naturalism, is what it is. Both cosmologies recognize that the infinite world of nature is beyond human control and boundaries. Whatsoever emerges in/from nature always resides within nature, not beyond. There is an inexhaustible abyss in nature that ceaselessly unfolds both order and chaos in a complex interdynamic that may and may not be pertinent to human sustenance, since nature is not a conscious agent that always patronizes its offspring. Nature, neverthe-

less, has a nurturing aspect or natural grace that can be an anchor for the existence of living organisms. These two metaphysical disciplines, Taoism and ecstatic naturalism, are also, in many aspects, congruent with the theories of science just explored. This congruence may be seen in regard to the notions of order and chaos, which some scientific theories portray as vital manifestations of nature spawning and sustaining life. Likewise, in ecstatic naturalism and Taoism, the subtleness of order and chaos engulfs human conscious into the swirling abyss of mystery of nature beyond human intelligibility, a mystery that radiates power, thereby becomes holy and demonic, depending on human projections and frameworks. Taoism and ecstatic naturalism, however, do not deny the sacredness of nature, believing this is not a hollow projection but the real of nature.

What these metaphysics provide for theological discourse is, firstly, that nature has a dimension beyond human intelligibility, which may look at times to be chaotic and demonic, but which should not be made abject by human defiance and fear, since this mysterious dimension is where everything originates. Secondly, the myriad complexities of natural phenomena should not be strained into a dichotomous simplicity, since there is no creativity or life without complexity. When nature is degraded in the human paradigm to "mere matter" to be manipulated and disdained, we lose our ability to perceive nature's dynamic currents and luminous beauty. Theologically speaking, nature's beauty is bestowed from God and respected by God. And God abides within nature in the form of love/spirit, which stimulates creativity, immanently interacting with the world's vital flow.

God blessed the seventh day and hallowed it

God's blessing on the seventh day signifies a meaning slightly different from the blessing of nature's abundance, which appeared on previous days. The seventh day does not indicate the completion or perfection of creation; the focus, rather, is on divine rest. If divine creative activity occurs as the hovering *ruah*, luring actualization from potentiality, the divine rest fuses with the subsequent transition phase from which the whole creation flows from its own fluid processes. The divine rest, therefore, does not refer to divine withdrawal from creation in order to be in solitude. The blessing assures this point. If God's rest was divine recession, what would be the meaning of the blessing? A more reasonable way to perceive the blessing is that God inspires the enhancement of creativity of the whole creation by fusing into it; in other words, God becomes fully immanent in the world. However, the real significance comes after the blessing. God "hallowed it"! Thus, the blessing may signify God's disdain for the human insistence on dominating nature rather than revering it. While in Genesis God hallows the whole creation, today human beings destroy it, as if the creation exists only for human purposes. The dichotomous dualism underlying the doctrine of creation ravages the deep wisdom of nature.

If divine creative activity occurs as the hovering* rūah, *luring actualization from potentiality, the divine rest fuses with the subsequent transition phase from which the whole creation flows from its own fluid processes.

The depth dimension of nature continually emits rich significations into the human world. Some of these significations radiate

divinity, which in turn evokes human-constructed religious significations. Problems arise at the juncture of the sheerly religious significations of nature with human order systems, and because of that, religious significations inevitably encompass socio-cultural milieus. As has been shown, patriarchical and hierarchical strategies in the reading of Genesis shroud and splinter nature's divine significations. Nature's fertile soil and depth have been exploited and desolated by those human order systems inclining toward power rather than wisdom. Human vulnerability--both physical and psychological--often wields power through systems of oppression and domination, affecting not only nature but also other human beings. A fixed notion of order against chaos is dangerous to any kind of justice. The ecological crisis, therefore, requires a more judicious consciousness that would attempt to heal the human estrangement from its origin, the spawning ground of nature. The abjection of the abysmal origin, the delusion of human superiority, the compulsive logic to simplify nature's complexity, the eulogization of the omnipotent God: all of these escalate the ecological tragedy. The treacherous logic of the human order-system shatters the interconnectedness and interdependence of human sustenance on nature. The reverence of nature—not romanticization of nature—is the fundamentally required sensitivity.

How we conceive of nature inevitably underpins how we read Genesis. Insofar as the classic doctrine of creation emphasizes static order over fluid chaos, we are kept from comprehending nature's dynamic creativity and beauty. Despite human efforts to apply human systems upon nature's currents, nature continues to flow through its own streams beyond human power. Demonic natural phenomena (from the human perspective), which include the ecological crisis, are also part of nature's vast power. Nature is not an object simply for human "use," but has a metaphorical subjectivity manifesting its own dynamic movements, even though this is far different from human conscious subjectivity.[20] There are, however, chaotic open spaces in nature that metaphorically and unconsciously permeate, with deep wisdom, through the boundaries of human order systems. The expanding universe: a conception that this is the place where theological discourse intertwines with philosophy and science to augment nature's rich wisdom. The veiled mystery of the universe remains too chaotic, incomprehensible, and unpredictable for human understanding to grasp completely. And this is partly because the universe is still creating and expanding, not only in its physical dimensions but also in its horizons of meaning, where veneration may emerge.

The abjection of the abysmal origin, the delusion of human superiority, the compulsive logic to simplify nature's complexity, the eulogization of the omnipotent God: all of these escalate the ecological tragedy.

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Endnotes:

1. Hawking, p. 138.

2. Ibid., 141.

3. Ibid., 156.

4. E. A. Speiser suggests that "At the beginning of...," or "When" instead of "In/At the beginning" are proper ways of interpretation for *bereshit.* See Speiser, p. 12. Terence E. Fretheim also proposes that "the word beginning probably does not refer to the absolute beginning of all things, but to the beginning of the ordered creation, including the temporal order;" thus, "God's creative work in this chapter begins with something already there." See Fretheim, p. 342.

5. The combat paradigm between God and chaos is often found in the Old Testament, such as Psalms 89 and 93, and Isaiah 51.

6. Corrington, *Nature's Self,* p. 4.

7. Corrington, *Nature's Religion,* p.129.

8. Careri, p.109. Quotation from Ahmed, p. 259. Emphasis in the original.

9. See Gleick. See also Briggs and Peat.

10. Briggs and Peat.

11. Fretheim, p. 344.

12. Ibid., p. 343.

13. See Kauffman.

14. Ibid., p. 26.

15. Ibid., p. 24.

16. *Tao Te Ching*, ch. 51.

17. Corrington, *Nature's Religion*, p. 123.

18. Ibid., pp. 61, 135.

19. Ibid., p. 102.

20. Sallie McFague proposes a "subject-subject" model, instead of "subject-object," for the human relationship to nature. See McFague, pp. 7-8. Jürgen Moltmann mentions nature's independent history that has subjectivity, by following Ernst Bloch's assumption. See Moltmann, p. 42. Korean theologian, Sang Sung Lee, also argues that nature has subjectivity in the sense that it has the ability to resist human exploitation. See Lee, pp. 171-175.

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Whewell's Wager: The Continuing Dialogue of Metaphysics and Physics in Science

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In his library at Trinity College, Cambridge University, around the year 1860, William Whewell (1794-1866) engages in conversation with a company of thinkers on the province of metaphysics and physics, to form a comprehensive scientific belief. In attendance with him are Lord Francis Bacon (1561-1626), Sir Robert Boyle (1627-1691), Sir Isaac Newton (1642-1727) , John Henry Cardinal Newman (1801-1890), Professor Alfred North Whitehead (1861-1947), and Pope John Paul II (b. 1920). Whewell proposes a wager: Is there a possible remedy to be found for the schism between the metaphysical and the physical elements of science?

> And new philosophy calls all in doubt,
>
> 'Tis all in pieces, all cohærence gone.
>
> — *The First Anniversary* [1611], by John Donne[1]

Introduction

William Whewell, professor of philosophy, eminent historian, philosopher of science, and Master of Trinity College, Cambridge, trusted that his contemporary practitioners of science were devout Christians who believed that the new science would champion religious belief. He himself contributed to the development of physics in his century, and in 1840 he introduced the term "scientist" into usage. In his writings, he labored to reinforce that biblical accounts could be reconciled with rightly proven scientific theories.

Lord Francis Bacon was a statesman, philosopher of science, and founding father of modern science in England. As the prophet of modern science, he introduced methodology and eliminated the medieval notions of metaphysics. He believed that the new science was not an academic or intellectual enterprise to increase the knowledge of nature, but a practical route to achieve human mastery over nature. Science, after all, should be useful. Order and harmony are mathematical balances in the universe where all causes and effects are reducible to motion in time and space. If one attempts to reason about the origin of space and time, one ends up in the realm of metaphysics; and mathematics is not metaphysics. Science is derived from the light of nature and the dictates of reason, in essence a human undertaking.

Robert Boyle was a natural theologian who found evidence of order and design both in the planetary system and in the laws of physics. He abandoned the dogmatic and metaphysical character of scholastic philosophy in favor of Bacon's idea of causal knowledge through empirical methods. He held

that some divine ends are coherent to all, and that it would be foolish to reject the theological proofs for the existence of God. Boyle was critical of teleological explanations and pursued a reasoned analysis to sensible facts by exact experiment. As a devout naturalist of the seventeenth century, he had a profound reverence for the Deity. Science was a religious task and he believed that the world would be interpreted religiously. God's will and character were found in the "Book of Revelation" and God's works were revealed in the "Book of Nature."

Isaac Newton stands in the middle of the significant transformation from the providentialism of former religious philosophy to a conceptualization of the future in which God maintains the rational order of the universe. By the eighteenth century, the conception of the world would be stripped of its theological and religious relations. The world would become a set of fixed geometrical motions and divinity will be lost, resulting in the complete despiritualization of nature. New expositions of the cosmos would be expounded in fundamental mechanical laws. All concepts of meaning and purpose would be dissociated from scientific thought. The mechanization of nature would exchange divergent being for convergent experimentation, achieving its final perfection: a world no longer needing God. The difference between the infinite and the finite would become the metaphysical.

Theologian John Henry Cardinal Newman contended that science and theology pursued different and separate methods of investigation. Nature, reason, and revelation come from the same Divine Author. He argued for a unity of knowledge whereby the natural occurrences of science would be found within the supernatural, and the physical and metaphysical would become one. The teachings of God lie within the lessons of the natural world, where its mysteries and miracles are divine messengers.

Alfred North Whitehead, mathematician and philosopher, offered a new and original theory of knowledge about God, the universe, and fundamental reality. Through unique metaphysical views and concepts, he proposed that science and mathematics are used to abstract patterns, and that metaphysics is ultimately dependent upon those patterns. In a constantly changing universe, God is the source of design and the conceptual ordering. Scientific belief in the order of nature emerges from the direct inspection of nature. Science suggests a cosmology, which in turn suggests a religion. Aided by science, the search for evidence of intelligence in the cosmos is a direct link to the divine activity.

At the start of the third millennium, scholar and philosopher John Paul II, influenced by Boyle and other thinkers, holds that faith, as God's gift to the human person, gathers knowledge of the Creator from the "Book of Revelation." Reason, using the "Book of Nature," challenges the natural intellect to question who is responsible for the natural world. He calls for a return to the sources of Christian faith to extract the meaning and significance of the critical questions of our time. Metaphysical reflection on ultimate human questions is joined with scientific research to find a deeper knowledge of the mystery of the universe. The expanding knowledge of the mystery of the divinely created universe, from the molecular to the cosmological, compels scientists to unite their search for scientific truth of the finite with the metaphysical truth of the infinite. This continuing search aims for that which is beyond and higher, and in that quest will expand the human vision of the mystery of God.

We are privileged eavesdroppers on the following Socratic dialogue in Whewell's library at Trinity College, Cambridge.

Whewell's Wager

Whewell:

No philosophy of science could be complete which was not also a philosophy of the universe and no philosophy of the universe would satisfy a thoughtful scientist, which did not include a reference to the power by which the universe came to be what it is.[3] Facts are verified by observation of the world and come to be seen as necessary truths within the external world. These universal truths are generated from ideas and are then brought to light from the phenomena in the external world.

For example, gentlemen, let us consider the following speculations: How did things come to be as they are? If there is a Supreme Mind, an Intelligent Cause, which is the cause and foundation of the universe,[3] is this also the source of the truth?

How does man have this knowledge of God, the Supreme Mind?

We begin with what we know, of what is sure knowledge, and how this knowledge can carry us to God. Those laws of the universe, discoverable by the human mind, are the laws of the Divine Mind. The philosophy of each science consists in the development of the fundamental ideas that organize and articulate the propositions of that science. After all, progressive science involves a metaphysical component, comprised of ideas or theories, and a physical component, composed of facts or observations. There is no real distinction between them. Ideas can never be independent from fact; there is a mask of theory over the whole face of nature. The clearness of our very ideas spring forth from the fertile vagueness of metaphysical soil.[4]

Bacon *[Boyle and Newton in agreement]*:

Nonsense. Scientists of this day have demonstrated that fact can be independent of idea. Furthermore, they have validated that theory is dependent upon observations, but that observations can be independent of theory.[5]

Whewell:

Consider, gentlemen, what I have stated in my editions of *The Bridgewater Treatises*, namely, that Nature acts by general laws and the resultant interactions are from causes which operate according to fixed and constant rules.[6] Nature is a collection of facts governed by laws; and the knowledge of nature is the knowledge of those same laws. Consider the arguments from St. Thomas Aquinas for the eternity of God.[7] Is not the explanation for the necessary existence of God as First Cause, similarly true? These proofs for the existence of the Deity are in the realm of the metaphysical—*a priori*, from ideas, and *a posteriori*, from effect. May not the same be true for the universe?

Boyle:

Some divine ends are coherent to all, so it would be foolish to reject the theological proofs for the existence of God. From the minds of Thomas Hobbes, John Locke, Henry More, Benedict Spinoza—and from you also, Sir Isaac—reasoned analysis leads to sensible facts confirmed by exact experiment. Reason and experience lay the foundation for the "new philosophy" in which the criteria for truth are mathematical and mechanical principles; they are the alphabet in which God wrote the world.[8] These mathematical truths are independent of Revelation, hence, Revelation must be interpreted in a way that does not contradict those principles which are the universal foundations of all knowledge. Mechanics transcends Scripture, and new definitions must be given to metaphysical terms. For instance, form is the mechanical attraction necessary to constitute a determinant body, rather than an essential quality. Nature becomes a system of mechanical laws in a distinct world of matter and motion rather than substance or mystery. Therefore, teleology and the ultimate question of "why" are invalid; for final causality is the immediate "how."[9]

In reverence for the Deity, I see science as a religious task, and this world should be interpreted religiously. Science and theol-

ogy are part of a larger religious faith in the divine origin and control of the universe. The Deity, as First Cause and Intelligent Being, reveals to us the orderly and harmonious system in the universe and is ever watchful through spiritual forces to hold it together. God, in His Providence, unites the universe through the universal Law of the Author of Nature.[10] The exquisite structure and symmetry of the world, where nature is skillfully contrived and once set by the first design, performs its function without further intervention. God's ends are within and transcendent to those which are revealed in the discoveries of science. The search for a Final Cause in nature is discoverable in the natural world. Here the naturalist can find evidence of teleology in the world which the telescope, microscope, and scalpel lay bare. The universal ends of God, the cosmic ends of the universe, and the human and animal ends of physical wholeness are observed. Man has a teleological importance in the cosmic scheme and a unique dignity as a child of God. The body is mechanical, but the soul is rational, unextended, immortal, and immaterial.

How God forms these operations is in the realm of the metaphysical. Reason, by way of careful exploration of the mechanical world, and the rational soul lead to the doorway of the metaphysical.

[Boyle]

Whewell:

Sir Robert, are you a true natural philosopher who seeks knowledge of all the sciences within the rational mind?

Boyle:

Utilizing the experimentalist method, one can discover in the world a natural religion. If reason were to focus on revelation, the more worthy is the field of endeavor. Religion gains from natural science, for God is the Author of the Book of Nature and the Book of Revelation. There is no conflict between them. The Book of Nature is an introduction to the Book of Revelation, a way to know God through contemplation of His works and the study of His word. Our Naturalist creed has three articles: Deity, Immortality, and Providence.

Whewell:

Is nature a "book" to be read, in which all parts have a definite connection and relation to one another? Can this be explained mechanically rather than mathematically, as Galileo, Copernicus, and Kepler have done?

Boyle:

The Book of Nature was written according to the twelve general principles of universal matter common to all bodies with the power of diversification, which is set into motion by God. The mechanical doctrines of generation, alteration, corruption, and modification have replaced Aristotle's idea of substantial forms with a corpuscular theory of matter. God is the Prime Mover, and the letters of God's Book of Nature are mechanical, for the world is God's epistle to man.[11] How God performs these operations is in the realm of the metaphysical. Reason, by way of careful exploration of the mechanical world, and the rational soul lead to the doorway of the metaphysical.

Newton:

We are religious scientists.

Boyle:

The natural scientist is the hesitant theologian who yearns for the truths of revela-

tion when considering the work of God, both in the mechanical world and in the soul of man. One is compelled to bridge from natural religion to revealed religion and to enter into Christian faith.

Whewell:

Are you separating scientific reasoning and faith?

Boyle:

Natural religion provides the existence of God, but God's will and character are only to be found in revelation. For revelation is experiential, a kind of divine experiment which encompasses the personal or interior, the historical , which is narrative testimony, and the theological , which is deduced from Scripture. Scripture reveals truths nobler than those of natural philosophy and superior to reason. The Book of Nature, natural theology, may show a part of God's works; but the Book of Revelation manifests much more in the mystery of the Redemption. Scripture declares the whole counsel of God, but not the whole nature of God. God is the cause of the universe and all creation.

Whewell

Sir Robert, how do you reconcile philosophy and theology with this experimental method?

Boyle:

Experimental science must stand independent from metaphysics, especially the scholastic forms. The habits of explaining phenomena by generalizations in nature, by deference to authority, and by the use of abstract reason without actual observation and experiment, must be cleared away. The method consists of questions or hypotheses and proofs based on probability and reproducibility in which both success and failure are reported and analyzed. The task of the scientist is to utilize, by reason, observation, and experiment, all acquired knowledge, and to link the many and divergent phenomena of the natural world. The consequent knowledge is formulated into a collective maxim and related to a higher cause, so that the physical properties of matter could be deduced from one another.[12]

Newton:

The mechanical design of looking at nature involves three different types of demonstration or proof. Metaphysical proof, by which conclusions can never be other than true; physical proof, by which conclusions are deduced from physical principles; and moral proof, by which conclusions are based on the truth of prudence and principles of practical philosophy.[13] The physical is inferior to the metaphysical and safeguards theological doctrines from scientific contradictions. Moral proofs serve as the basis for ethical arguments.

Whewell:

Do I understand that you are speaking of the concept of design, Sir Isaac?

Newton:

By means of scientific principles, God's action is seen in the structure and order of the world. Principles that permit one to recognize that the universe is an effect of choice, and not of chance or necessity.[14] Natural philosophy, defined in this way, transcends nature and leads one to God.

Boyle:

The design concept allows one to infer design and to investigate the character of that design experimentally by scientific methods. God's Hand can be read in both man, a sort of microcosm, as well as in the world or macrocosm; the contemplation of both leads one to the multiplicity of the Creator's wisdom. In the world, design is in the general fabric of nature, animals, and plants; in man, it resides in the body, in the intentions, and also in the soul, the end of these intentions. The design of natural religion is the human mind, the rational soul.[15] Man's rational soul is the immaterial and immortal being; and its nature is known

through introspection, observation, and revelation. The evidence for the action of God in the soul is seen in the rationality, spirituality and immateriality of the human mind. That wondrous mechanism of the integrated body and soul can only be by the Master's Hand, God's alone. This is the greatest evidence for the presence of God in the world; such contemplation should forestall questioning any of the doctrines of the faith.[16]

Whewell:

You will be remembered, Sir Robert, as the "devout" naturalist of the seventeenth century—one who made the world his library and his oratory.[17] But what of this rational soul and the generation of ideas with regard to nature? Would you say it were better to have a little knowledge which is certain and based on experimentation and careful observation, or to construct grand hypotheses of the universe?

Nothing happens by chance but only according to the plan, design, or idea of the Divine Mind. The immeasurable distance between the truths in the human mind and those in the Divine Mind is the universe.

[Whewell]

Boyle:

The development of science is characterized by the continual competition between distinct views or ideas about nature that are derived from and compatible with the dictates of scientific observation and method.[18] Human knowledge is limited by its tentative and gradual progress; it is small and finite in comparison to the totality of being. The new science needs definitive experimental standards, because hypotheses differ in value and probability of truth. There can be no absolute system of truth, for new information comes without promise of a compatibility with present hypotheses.

Whewell:

Indeed, the ideas and truths in our mind agree with the laws of the universe and the facts of the world, because our ideas are given to us by the same power which made the world and caused them to agree—ideas such as space, giving rise to the laws of geometry as propositions or necessary truths; time, conforming the events of the universe to necessary laws of succession; force and matter, establishing the universal order of the universe; substance, creating the quantitative nature of the universe verifiable by observation of the changes within its quality; and, final causality in organized bodies, governing the laws in organic nature. Thus, nothing happens by chance but only according to the plan, design, or idea of the Divine Mind. The immeasurable distance between the truths in the human mind and those in the Divine Mind is the universe.

Boyle:

The difference resides in the individual views of the universe and the practice of science in it. Observation and experience define the limits of scientific belief, but not the core of scientific belief. The arbitrary element of personal history and judgment become a formative ingredient that shapes the essence of scientific commitment. Scientific investigation begins with a belief and a desire to find the answers hidden within nature, followed by an effort to forge them into concepts through the might of the human mind. Man's commitment to this endeavor has fueled the real episodes of scientific revolution.

For example, Copernicus and Newton rejected time-honored theories of astronomy in favor of an incompatible one. Their efforts have transformed the scientific imagination and extended the limits of scientific

discovery. The courage to challenge the rules of methodology and to implant new theories for reevaluation of prior fact is the defining characteristic of a scientific revolution.[19] In our time, mathematics, physics and mechanics have been separated from natural philosophy and an entire constellation of beliefs has been reordered to new principles. This new science is rich in empirical understanding, but it is in search of philosophical understanding.

Whewell:

Ah, but there exist an external, or scientific, and an internal, or philosophical, understanding and knowledge.[20] Laws governing the external mathematical and physical universe as to its identity and order are ruled by the infinite number of ideas within the Divine Mind. Knowledge of the universe is independent of creation and suggests a beginning formed by natural causes from a former substance. The progress of scientific knowledge derived from the observation and speculation in the physical sciences depends upon conforming the objects and events of the universe to the ideas within the human mind. Intellectual progress is the idealization of facts.

Internal knowledge, however, is man's personal and moral nature. According to Aristotle, man is a practical and speculative being who acts and contemplates. In the depth of that contemplation, there is an aspect of action that is inevitably distinct, being either right or wrong. In order to create moral beings as part of the universe, the Supreme Mind or Intelligent Cause has given human beings the idea of right and wrong. Choices and actions belong to each being as the personal expression of that being, or human nature.[21] Human beings have both a law on these subjects written on their hearts, and a conscience which accuses or excuses them. Thus, humans are knowingly the subjects of Divine Law. This earth is the scene of moral trial, and moral advances are made by improving the state of things and producing good through ideas of justice and benevolence. Moral progress is the realization of ideas.[22]

[He pauses briefly before changing the course of his reflection.]

Let us consider the role of metaphysics through history. Initially, metaphysics was the unifying thread of wisdom that composed the entirety of knowledge in every field. This is a belief system that unites man, the universe in which he dwells, and the Master Designer of that universe. Both man and nature occupy a central and interdependent place within the universe according to that Design and share a kinship/guardianship with the Eternal Designer.[23] Nature is intelligible to the mind of man. Therefore, one studies the grand pattern, or universal nature of Being, through the various sciences together in a conclusive whole.[24]

For instance, before the Newtonian age, science was equivalent to natural philosophy and the greatest philosophers were the greatest scientists. Philosophy dominated science. But science then came into its own. Geometry was the link between antiquity and modernity in science. Plato expanded the Pythagorean idea of numbers and used geometry to illustrate ideas in which the ultimate elements of the cosmos were spatial concepts.[25] In the Middle Ages, geometry predisposes to a fuller mathematical interpretation of nature. This line of thinking was extended in the fifteenth and sixteenth centuries with the insertion of algebraic symbols and equations for scientific investigation. Galileo, Copernicus, and Kepler used geometrical reductions to establish the relativity of mathematical values in the interpretation of nature. The purpose of the method was to isolate the phenomenon, to intuit its elements, and to translate it into a mathematical form. The final resolution of the fact apprehended by the senses became a mathematical "form," and mathematical harmony became the new version of causality. God as the great Geometrician had created the world in mathemati-

cal terms. The real world was a world of quantitative characteristics where the differences were in number only; all certain knowledge was mathematical. Aristotle's nature as a world of common sense experience gave way to verifiable mathematical hypotheses drawn from the observed world.[26]

In the seventeenth century, science developed its own criteria of truth and cast doubt and suspicion on the faith of the Christian religion. After your work, Sir Isaac, any reconciliation of Christianity with science called for the adjustment of Christian beliefs to conform to the conclusions of modern science.[27]

Newton:

Thought is a Divine gift, but it cannot of itself come to knowledge; it requires the perceived motions within nature for its expression. Presently, that expression is mathematical. Metaphysics applied to the categories of physical space and motion is now a purely mathematical concept. Reality in the universe involves bodies moving in space and time.[28] Aristotle determined space as contained, not extended; and as enclosed, not limitless. For Aristotle, nature was qualitative to a final cause. But Galileo, Copernicus, and Kepler gave nature an independent mathematical existence, in which causality was the motion of the atoms and their unique mathematical changes. Nature is a self-contained mathematical machine determined by the motions of matter in space and time.[29]

Boyle:

Further, Descartes showed us that mathematics is the unique door to the secrets of nature and knowledge. Teleological and mechanical—this was metaphysical dualism! How are man and nature to be justified as separate, yet constrained by the same laws? Mathematics tells us of boundaries and interactions but not of substance; it abstracts from physical objects to the extension of space. Defined by *res extensa*, the real world is extended, independent of thought, and mathematical in quality; *res cogitans*, the philosophical, rational and conceptual knowledge of essence and substance has been lost.[30] God has been relegated to the first cause of motion, and the continuation of that motion was the working of a great mathematical machine by His general concourse. Is the "how" more imperative than the "why"? Without the essence of pure thinking, can the links in the great chain of Being be connected mathematically? Another circle broken!

Whewell:

The richness of post-Newtonian mechanics yielded the scientific discoveries of gravitation and centripetal movement of the celestial bodies, infinitesimal calculus, and quantitation of force and mass—or by some thinking, inertia. In turn, scientists have unified experimental and mathematical methods and separated positive scientific enquiry from questions of ultimate causation. Newton attempted a metaphysical groundwork for man with mathematics and the nature of space, time, and matter as the new being.[31]

However, reductionist ideas prevailed. Now all valid explanations must be in terms of small, elementary units that occur in regularly changing relations; ultimate causality is found in that motion.[32] The enquiry into being is replaced by the search for the right method to reach truth. Methodology, in preparation of the conditions necessary for the attainment of knowledge, has become the new way of science. The world is observed in a new mechanical framework that defines the content of the questions to be raised. Philosophy and science are equivalent and open to judgement by the same principles. Eventually, this redundant sequence has permitted science to separate from and dominate the philosophy of nature.[33]

[He turns toward Bacon.]

What say you, my Lord?

Bacon:

If all activity and change are motion, Professor, I would ask, then, is not thinking a kind of motion? And are not those mental

processes most easily expressed by geometrical mechanics? If Thomas Hobbes is correct, then there is no reality in universal essences or being; essence without existence is a fictitious ingredient of the mind.[34] Reasoning is a series of patterns or images; and are not the most elemental patterns mathematical? Externally these images are motions confined by space whose extension is defined geometrically. Ah, now that, Master Whewell, is causality! Particular being, in the present, is in nature; in the past, it is in the memory; and in the future, nonexistent, for it is a myth in the mind. Being is reducible to a material quality of the senses.

Boyle:

Now if Henry More were here—nay, if all the Cambridge Platonists were at hand, we would be told that not only matter but spirit also must be extended. Furthermore, spirit can impart motion to matter. Extended spirits occupy space and have a dimension wherein the soul lies.[35] More has written that the phenomena of the world cannot be explained by mere mechanics, that there must be a substance distinct from matter. Extended spiritual substances are in accord with our own purposes, for they set our will in motion, and, as "spirits of nature," maintain the diverse parts of the material universe in a non-mechanical unison.[36]

The will of God is expressed in the world of matter, perhaps through some æthereal spirit as an active agent within nature that unites nature in an orderly and purposive system.

[Newton]

Bacon:

More is a lost medieval mystic who believes in Plato's *anima mundi* and the universal soul of the world. What motion can exist beyond the very laws that define motion? Order and harmony are the mathematical balances in the universe, not a higher order that is rational, purposeful, and supreme. Space is mathematical, not divine. If God is an extended Being, beyond the mathematical definition of space and time, is He not also a metaphysical myth?

Newton:

Elementary mathematics teaches us to measure in fundamental units and render exact numerical forms of a definite known quantity. This implies a constancy in nature and presupposes the existence of God, the Efficient Cause of all things. The will of God is expressed in the world of matter, perhaps through some æthereal spirit as an active agent within nature that unites nature in an orderly and purposive system.[37] Space and time have potentiality and support the omnipresence of God in an infinite and homogenous absolute entity independent of bodies, motion, and human knowledge.

Boyle:

In his relationship with nature, gentlemen, man retains a teleological importance in this cosmic scheme and relies on Providence. His worth and unique dignity ultimately rest in being a child of God. Man's body is mechanical, but he has a rational soul, a soul that is unextended, immaterial, and immortal.[38] Some Divine ends are readable by all, others transcend our intelligence, and truly the reach of human knowledge is humble compared to the totality of being. Certain knowledge is more valuable than the greatest speculations of the universe; careful observation and experimentation reveals genuine knowledge.[39] I speak from the most profound reverence for the Deity and point to the order, adaptation, and beauty in the universe as proof of its divine origin and control. This divine Intelligence is the Being that maintains the har-

mony in the universe, and His Providence is exercised in its exquisite structure and symmetry. This is His general concourse.[40] The universe as a whole is not mechanically explicable, but only religiously so.

Whewell:

But what has caused this divergence between science and that great wonder of being? The new scientific metaphysics claims an ultimate reality that is causal and attainable to man's mind. It is contained in the concepts of space and time. The change lies in the interpretations of reality, causality, and the human mind. What has changed? Firstly, the real world is no longer one of substances defined by a myriad of qualities, but now a world within of atoms defined by mathematical laws, not by Aristotelian qualities. Secondly, causality is no longer a matter of forms and final causes but rather explained in the reductionist tomes of simplest elemental particles. Further, the human mind is a center of mechanically generated sensations and ideas with no union to the Supreme Intelligence. Our enlightened scholastic faculties have been reduced to the mechanical motions of images set in a mosaic of elemental particles. Bah! Soon modern beliefs will have scientific thinking categorized by the event it is contemplating as a structured mass of mathematical analysis. What a blow to the universal drama of thought! And what of the diverse and unstable moral paradigm? This was to become fact in the form of scientific materialism, Immanuel Kant's new metaphysics, and the process philosophy of Professor Whitehead, here amongst us.

The medieval ideas of space and form gave us boundaries. The new methods and logic of science have taken away these limits and cast us into boundless and hollow mathematical reductionism. The heart of philosophy has a similar void, which is the loss of the spirit of metaphysics. The breath of philosophical life, that light which grants a glimpse of the genuine ways of arrangement that nature has to offer to our understanding, has been reduced to an instrument for the mathematical conquest of the world.

Bacon *[to Whewell with emphasis]*:

Let us reconsider this matter, Professor. All causes and effects are reducible to motion in time and space, not to little drafty places in our corpus. There is no perfection or Deity involved in these laws, merely elementary units of mass whose behavior can be expressed in the form of equations.[41] There are no explanations except for scientific laws. This is motion's value and empirical destiny. If we attempt to reason about space and time and their origin, we quit the region of science and end up in the realm of metaphysics, and then are we not like Milton's fallen angels, where one "finds no end in wandering mazes lost."[42]

This Divine Intelligence is the Being that maintains the harmony in the universe, and His Providence is exercised in its exquisite structure and symmetry. This is His general concourse. The universe as a whole is not mechanically explicable, but only religiously so.

[Boyle]

Whewell:

If there is value in the universe, is there not a place for teleology? Does this not account for its nature as value? An idea worth living for is justified in itself, regardless of its empirical destiny, is it not?

Bacon:

Value in the universe implies that the universe is an intelligible and rational one;

a rational structure of nature is the foundation of our modern science.[43]

Newton:

Professor Whewell, to ascertain this value of yours, a new metaphysics must be constructed.

Whewell:

You have come to the heart of the wager, Sir Isaac.

Newton:

Yes, perhaps; but in the mind, the conception of nature or the physical world is in terms of space, time, and mass. God's existence and His relation to the universe will be unmasked by science in the nature and function of the æther. Man, as being, has a perceptual and knowing contact with this physical universe; man as *anima*, or soul, has contact with the sensory impulses experienced within the sensorium of the brain.[44] Here he experiences God, the Originator of the objects man encounters as images.

I have no tolerance for hypotheses as deductions from observed phenomena and have concluded the *Principia* with a classic rejection of them.[45] There is no *a priori* certainty that the secrets of the universe can only be divulged by mathematical means; as heir to Boyle's method, I concur that experimental verification must support true reasoning. After all, an experiment is a question put to nature by a natural philosopher who must determine the language that nature understands.[46] For Aristotle the language was sensory and metaphysical; for Galileo it was mathematical and physical. Copernicus, Kepler, and Borelli heard it in the order of physical phenomena. During this period, the efforts of the human mind in the search for truth were both spiritual and intellectual, but the mathematical is the foundation of this new and revolutionary metaphysics.[47]

The foundational principle is simplicity; there is uniformity in nature. Diverse natural effects, expressed by the same equation, must be regarded as the product of the same forces. Empirically, the qualities of bodies are universal to all bodies; and by experimental philosophy, empirical data is true until proven otherwise. Deductive logic is not scientific because it is not drawn from external phenomenon. Science is the body of absolute and certain truth about the events of the physical world. For the present, the nature of the forces in motion is beyond experimental verification and can only be reduced to mathematical laws. Ultimate nature is unknown; we seek to know how it acts, not what it is. This is a rather positivist stand, but exact knowledge is more valuable than speculative knowledge, and therein lies the value in the universe.[48] Teleology is in the unconditional surrender of nature to the mind of man. After all, are we not just irrelevant spectators of this vast mathematical system of motion which comprises the world of nature?

Whewell:

What of your spirituality, Sir Isaac? How do you perceive the Deity in your scheme?

Newton:

Space is geometry and time is the continuity of numbers. All sense is relegated to the sensorium. As for the external universe, well it is a quantity of mathematical computable motions existing in mechanical regularity under the influence of definitive forces.[49] The law of gravitation has united astronomy and mechanics into a singular mathematical science of matter in motion.

Whewell:

For these very ideas, along with that of absolute space, Bishop Berkeley in 1710 labeled you an atheist. He also writhed under the incorporation of this idea into the Cartesian geometrical machine.[50]

Newton:

I addended the second edition of the *Principia* in 1713 with the *General Scholium*. The original concepts of absolute space and

time were extended to moving in God, the Creator of all things, who has absolute dominion and control of these events. Further, in the *Opticks*, I have defined space as the Divine Sensorium in which the universe exists and the will and intellect of God comprehends and guides the physical world. Absolute space is the Divine knowledge and control of the omnipresent God, who by His will forms and reforms the universe within His boundless sensorium. God is the ultimate Originator of motion, and both real and absolute motion result from the expenditure of Divine energy.[51] My dear sir, this is the essence of Newtonian spirituality.

Metaphysics is becoming more and more an antithesis to science these days. It is now considered nonsense and eliminated from the view of the world. Yet, progressive science involves a metaphysical component and a physical component, with no real distinction between them.

[Whewell]

Boyle:

Religion is a separate discipline from science, but dependent upon the Creator's Hand in the universe.

Newton:

Religion is a realm different from that of science, yes; for the conclusions of religion cannot be proved nor disproved by scientific standards. Every step of natural philosophy aims closer to the First Cause. The knowledge of God is not detached from the world science seeks to know. Religion and science are fundamentally different interpretations of the universe. The sphere of science is dependent on the Deity who leads the reverent mind to a fuller assurance of His reality and to a willing obedience to His commands. I have written as many theological treatises as scientific dissertations, and I believe that religion is basic to science. However, one must also experience religion apart from science, and science apart from religion.

Whewell:

I would say, Sir Isaac, that you are a pious Christian who seeks design and intelligence in the universe.

Newton:

Once again, in the *Optiks*, I have shown undeniable evidence of intelligent purposes in the universe and cosmic order. Ultimate causality is the direct operation of God in the production of motion. Master Whewell, your teleology is merely the simplicity of nature and planetary movements of the celestial system. God is responsible for the intelligent order in things that makes them worthy of reverent contemplation.[52]

The world could not have arrived out of chaos by the mere laws of nature. After the Deity's first handiwork, is the world of nature independent of God for continued existence and motion? I think not. The Creator's power and dominion are always at work in the daily cosmic economy. He prevents the fixed stars from collapsing together in the middle of space and He continually and providentially reforms the world to sustain its incomparable beauty, order, and harmony. This cannot be preserved by space, time, and mass alone; it requires the continual effort of that Divine will which freely chose this order and harmony as the ends of His first creative toil.[53]

Whewell:

From these reflections emerges a theory of necessary truth. Science, through the scientific method, contains the fundamental

ideas that are the sources of necessary truths, or the associations upon which the existence of the science itself depends.[54] These necessary truths, as propositions, have reference to empirical realities that are proved to be true in the course of experience. The resultant fundamental ideas are the principles that the mind contributes to knowing and provides as the subjective forms for interpreting experience into knowledge and truthful statements. In this way, the philosophy of each science consists in the development of the fundamental ideas that organize and articulate the propositions of that science.[55] Empirical facts are judged to be necessary laws when they are idealized and empirical truths become necessary and universal.

Whewell *[musing to himself]*:

Metaphysics is becoming more and more an antithesis to science these days...especially since the inductive epochs of Copernicus and Newton. It is now considered nonsense and eliminated from the view of the world. Yet progressive science involves a metaphysical component and a physical component, with no real distinction between them.

Newton truly stands in the middle of a significant transformation from the providentialism of earlier religious philosophy to the relegation of God to maintenance of the rational order of the universe. By the eighteenth century, his conceptions of the world will be stripped of their theological and religious relations. The world will become a set of fixed geometrical motions, Divinity will be lost, and the result will be the complete despiritualization of nature.[56] I doubt Newton had this in mind. I wonder if he anticipated it.

In the future, this new conception of the cosmos, as an indefinite and infinite universe, identified by its fundamental laws, will equalize all ideas of being. Scientific thought will eventually disregard all concepts of value—perfection, meaning, and purpose—to the obscurity of being.[57] The mechanization of nature will exchange divergent being for convergent experimentation, and its final perfection will put forth a world no longer in need of a God. The difference between the infinite and the finite is the metaphysical.

Newman *[to Whewell]*:

As a fellow Trinitarian, sir, I believe that by our reason and by that instrument, the dialectical method, we can arrive at true knowledge of a unified science. The liberation of modern science from theology by the middle of the nineteenth century, after all, is not of interest to all theologians. Many are trying to promote a more inward and spiritual practice of religion.[58] The Roman Catholic Church grounds faith in the dogmatic authority of the Church, rather than in knowledge attained from natural theology or physical science. However, imagination and feelings must be kept under the discipline of reason, to balance the intellectual with the spiritual so that the human mind may give assent to God.[59]

Lord Bacon would have us believe that atheism and science were united from the beginning with the Greeks, and that religion was the ruin of science.[60] He further claims that one must judge by pure evidence and, in that case, physical science is not theology. Final causes and the existence of God are separate from physical science and established laws. It is true that science and theology do pursue different and separate methods of investigation. Induction is the instrument of physics and deduction is the instrument of theology. Nature, reason, and revelation come from the same Divine Author, whose works cannot contradict each other.[61] Thus, knowledge forms a whole, and it may be perceived when the natural occurrences of science are found within the supernatural.[62] The metaphysical and the physical are a unity. One is found within the other, as Aristotle described in his superior and natural sciences.[63]

Bacon:

Certainly, Your Eminence, no new truth can be gained by deduction. Newton, by pure induction, has revolutionized astronomy and physics. What can be gained outside of experimentation? Mathematics, not metaphysics. Is not physical science to serve man? Theology must be derived from God; science is derived from the light of nature and the dictates of reason. In essence, science is born of man.

Newman *[to Bacon]*:

In revelation, the manifestations of the Almighty exist in the teachings of the natural world, my Lord, but are not taught by nature. Your science is impatient of mystery and doubtful of miracles[64] It remains fixed in its laws and stays within the material system from which it began. The end of your quest for knowledge is mechanical, beginning and ending with matter, not philosophical and forging deeper into the mind.[65] You pursue science but not the nature of science, and there is where your quest fails as a philosophical process and why it cannot be an end in itself. This is science without metaphysics.

We know God in the cosmos and in the universe of the human heart—*cor ad cor loquitur*—through the personal dialogue and friendship between man and God[66] The material world, the individual soul, and human history are the natural messengers concerning God. And their assertions are received through inductive inference, which is a harmony between the methods of probable reasoning and metaphysics. God both hides and reveals himself in nature.[67] Just, as science is an ongoing enterprise, so also is this dialogue in nature an ongoing enterprise.

Bacon:

Do you deny, your Eminence, that the meddling theologians have trespassed upon the scientist's field of investigation? Physical science and the knowledge gained from it are to serve man in the innumerable inventions that promote the ease of life. Knowledge is power, not argument or ornament. It must lead to action, not to contemplation. Man's goal is to master nature and thereby enlarge the powerful human empire. Human understanding is infused by the will and the passions; these are the machines that drive science, not ideology and contemplation. With science as the master, a new social order will come to be in which everything is possible to man[68]

Newman:

Every new discovery has occasioned the scientists to dismiss God from the universe. There is no mention of Thomas Aquinas or the weight of the arguments for the existence of God, whom it is easier to dismiss as Creator, and concentrate on His Creation, the universe. Scientists are impatient, yet they tolerate insufficient and often absurd interpretations that lead to shallow generalizations or flippant judgments in which the mind responds without sufficient data.[69] The object of knowledge is truth, facts which are related and stand together. All knowledge forms the whole, which is everything, contemplated by the human mind in a system of knowledge without limits. It is gained slowly, for this whole is the universe. Science is only a partial view of the mind from abstractions founded in the relations of things rather than the things themselves. Science ranges and classifies facts, traces effects to a cause, and transfers knowledge from memory to philosophy.[70] No science fully can enlighten the mind to the whole; the universe is so intimately knit together that we cannot separate portions except by mental abstractions. And what is mathematics, but abstractions separated from the whole? The Creator is the One, the Being of the whole, separate from it, yet so intimately implicated within it that we cannot fully contemplate it without contemplating Him.[71]

Bacon:

Do I detect the insurgent strain of metaphysics, your Grace?

Whewell:

The wager has been defined.

Newman *[to Bacon]*:

Is there not a mental formation in the method of science, my Lord? And is not the practice of that formation founded in man's nature? Then, there must be a unity of knowledge, founded in man's nature and the necessity of things, from the great moral works to the course of daily life. It is the habit of using an idea by intellect and by sense. It is philosophy! The essence of science is the formation of scientific knowledge after an intellectual digestion, that is brought into the whole.[72] As a habit of mind, this breadth of thought takes in the great universe, moral and material, sensible and supernatural, and is surpassed by the thought of its Maker.[73] He is the One, the Whole, the Being who gives birth in the mind to numerous and distinct truths, each more mysterious than that found in this universe of space and time. Formation, unity, truth, and science all reside within and generate from the Whole. Ideas take on life in the mind, my Lord, and that life is metaphysics.

Scientists are impatient, yet they tolerate insufficient and often absurd interpretations that lead to shallow generalizations or flippant judgments in which the mind responds without sufficient data.

[Newman]

Whewell:

The dialogue to this point, gentlemen, has questioned the separation of physical science and metaphysical knowledge. Is there not a way to start a new program to integrate metaphysics, physical science and even cosmology?

Whitehead:

When one studies the history of science to our time, I believe there is a ground for developing a unity. Firstly, mathematics has given us the unique notions of spatiality and pattern, as presuppositions for modern science to express itself.[74] The infusion of patterns into natural occurrences with stability and modification, is the necessary condition for the realization of experience. Relationships and examples of patterns are key to the relativity of existence and how things are connected. In the physical world, science and mathematics are used to abstract patterns from particulars and actualities.[75] Metaphysics is ultimately rooted in the character of such actualities, or actual occasions, that are dependent upon patterns.[76] Nature is observed through the senses and initially is independent of thought. The knowledge of nature is reached by way of fact, which begins in the senses and ends integrated into thought. This experience is an active entity that is related to other entities and by comparison results in recognition or knowledge.[77]

Whewell:

This new metaphysics, then, encompasses the mathematical and the conceptual from the senses, but does it include the philosophical, the spiritual or the religious?

Whitehead:

True, this new mentality has altered the imaginative content of the mind, so that old stimuli provoke new responses, leading to a more balanced mind.[78] The universe never rests; the actual entity who does the conceptual ordering is God, the source of all possibility and the world's original design.[79] The medieval scholars insisted upon the rationality of God, and modern science is a derivative of that theology. Faith in reason and in the

order of nature springs from the direct inspection of nature, knowing that nature includes the harmony of logical reality as it lies upon the universe and the aesthetic achievement that stands before it.[80] Science suggests a cosmology; and cosmology suggests a religion.[81] One must enlist the aid of science to search for evidence of intelligence or life in the cosmos and then relate that activity to the Divine activity.

But science must also be philosophical so that it may criticize its own foundations. Induction, as Lord Bacon, here, introduced it, presupposes metaphysics and rests upon rationalism; that is, proceeding from particulars—or phenomena—to relations and interactions between particulars[82] But the great forces of nature as observed in the drama of the universe were abstracted to measurable quantities to fit the mathematical systems. Scientific thought is a closed circle of abstraction, and philosophy is the critic of that abstraction.[83]

The discussion to this point has questioned the separation of physical science and metaphysical knowledge. Is there not a way to start a new program to integrate metaphysics, physical science and even cosmology?

[Whewell]

Whewell:

But what of the natural world, surely it is not just a machine; then we are back with the Newtonian worldview. The world is not devoid of intelligence and life, but it is a circle, tracing the path of human life, the globe of the earth, and the sphere of the heavens. It is disorder and not clarity that comes from the mechanistic fracture of the circle.[84] I maintain that there remains a cosmic unity, coherence, and a true wisdom in the universe.[85]

Whitehead:

Within the new systematic metaphysics of diverse entities, there is a coherent set of concepts, albeit experiential, including God, that combine the aesthetic, moral, and religious interests with those emanating from nature and science. The concentration is one of "becoming" not one of "being."[86] Reality is the process of coherence seen in specific patterns that are interdependent and interactive. Reality is participation. The interaction is communication where each level receives from a previous one and influences the next pattern of activity. In practice, this is information; specific relations defined by their immediate context. Nature is a community not a machine.[87]

Whewell:

If information theory is contextual, what gives a message a specific meaning?

Whitehead:

A given sequence of symbols, whether transmitted by genes, memory, symbolic language or by cultural artifacts, is coded, transmitted, decoded, and interpreted for a specific meaning. The context determines the processing system that is selected from an open system of possibilities, and the sequence pattern instructs the information processing.[88] It is a flexible process that is continually being redesigned.

Whewell:

Did I hear design? If information is an ordered pattern, what is the source of the order in the pattern? Is pattern also design?

Whitehead:

Information has a mathematical design, for instance in quantum theory, where the mathematics involves a set of familiar equations that denote an observation.[89] The key component of design is information; but as to the nature of the intelligence of that design, and hence that information, even science has failed to provide an explanation.[90]

Whewell:

Then one can say that mind and intelligent design are not for mechanical forces or chance, but are necessary causes for an intelligent system. Creation, then can be interpreted as God's input of pure information in the articulate design of the universe.[91]

Whitehead:

Yes, in the sense that every entity, or information, is a unique synthesis of the patterns that form it; and the interacting networks are summoned forth by God.

Within the new systematic metaphysics of diverse entities, there is a coherent set of concepts, albeit experiential, including God, that combine the aesthetic, moral, and religious interests with those emanating from nature and science.

[Whitehead]

Whewell:

The project of metaphysics into modernity has taken a very analytical turn. But what of the unity of faith, reason, and metaphysics? All attempts to reconcile a belief in scientific theory and a belief in God seem to abandon God in the ultimate cosmic process.

John Paul II:

Consider, firstly, St. Augustine of Hippo. In bringing the doctrine of Creation into clear focus as a relationship going beyond the material world, he describes it as a total bringing "to be" and the sustaining and affirming of the existence of the universe.[92] The Creator is not temporal or defined by a temporal process. Creation proceeds indefinitely and sustains all things; the design, information, and intelligibility we discover are a reflection of the Divine mind. The stability in nature is a part of God's process and it makes natural science a possibility. That process is the relationship between nature and the ideas to which they are a witness.[93] The source of the information perceived as intelligent design is God's process and purpose in the distinct act of knowing and willing. God has woven capacities into the character of the world from its first appearance; it reflects His purposes and He can be seen through it.[94] All things come from the Creator's hands. The searching is for the truth and knowledge that first lies within, before it can be revealed externally in the natural sciences.

The unity of science and religion must begin with a metaphysical unity. For it is in unity that the human mind is driven toward understanding. And such understanding for science and religion will be achieved when faith and reason are again united in a common structure. The metaphysics of the one will illuminate the many and make sense of the whole.[95]

Whewell:

What is the source of this metaphysical unity and how is it achieved?

John Paul II:

Objective and universal truth and the reflection of being together comprise the metaphysical unity, each an essential condition for the other. The way to achieve it is through dialogue between persons, that unique form of exchange which responds to the human desire to know the truth.[96] There is a central relationship between faith and reason, science and philosophy, and their mutual journey in the search for truth. The answers to the questions of meaning reside in fundamental truths which can only be discovered through a progressive, perpetual journey of the human mind and heart to a relationship with God. The path to truth in scientific inquiry is also a way to the truth of the workings in the natural world. The laws of nature testify to the Laws of Divine Providence. The truth does not reside in the

thinker, although the human person has a natural inclination for truth.[97]

But this attainment of truth must have a clear direction. Faith, as God's gift to the human person, places divine truth within the mind to shepherd reason and promote a true evolution within the reason. The first stage of truth from the "Book of Revelation" is read in the "Book of Nature" with the aid of human reason and can lead to knowledge of the Creator.[98] Reason must search for the understanding of Revelation in light of faith, just as with the researches in natural theology. For nature testifies to the God revealed in Scripture and challenges our natural intellect to question who is responsible for the natural world.[99]

Any exclusion of metaphysics from the study of the physical universe denies the dependence of every creature upon God and subverts the meaning of human life and of all the universe. The created world is not self-sufficient.

[John Paul II]

Whewell:

It appears, your Holiness, that your proposal for a unified metaphysics includes more than scientific inquiry.

John Paul II:

With only reason and scientific inquiry as the guiding philosophy, rationalism and scientific positivism have reduced all mystery to dialectic and discourse. When faith is prohibited from the rational enterprise, there is a metaphysical shift from the transcendent and the personal to the technical and the accumulation of scientific fact. Lord Bacon's idea of the mastery of nature has extended to the human person and has driven philosophy from the pursuit of universal wisdom to utilitarian ends.[100] It is the outcome of the scientist's work and intellect that has created a deep distrust of reason and the demise of metaphysics.[101]

Whewell:

How do you propose to renew this metaphysical spirit in the ongoing scientific enterprise? And what is the value of this metaphysics to the human person in a scientific age?

John Paul II:

There must be a *ressourcement*, a returning to the sources of the Christian faith to extract their meaning and significance for the critical questions of our time. A spiritual and intellectual communion also calls for a return to the passion for truth and the knowledge of the universal absolutes of meaning. The human being is immersed in a set of truths and values derived from belief and from personal questioning.[102] The realm of scientific truth, at this point, is taken as true, without further inquiry for verification. By nature, the human being believes and trusts, forming a richer experience in relationship with others.[103] This yearning for interpersonal and scientific truth calls for an entrusting relationship between truth and those with whom the experience is shared. A similar relationship exists between revealed truth and philosophical or scientific truth in the fulfillment of reason. A rational foundation for belief and for seeking truth is in place whereby reason may rise to a higher plane of thought for the perception of being and transcendent truth.[104] Reason fuses divine revelation with the human "Book of Nature," where it finds meaning and a form of knowledge that is unlimited. Faith then augments and perfects reason.[105] Metaphysical reflection on the ultimate human questions are joined with scientific research to find a deeper knowledge of the mystery of the human being and, by extension, the universe.[106]

Because we question, we are by nature philosophers. Speculative inquiry, which is

characteristic of both theology and scientific research, demands disciplined thought to achieve true knowledge of all created realities. The right use of reason must render one able to articulate this knowledge in concept and in argument.[107] Metaphysics, which has objective truth as its foundation, unites the human person, the world, and being. In studying the truths of revelation and the created order, the knowledge gained by faith and reason in concert uncovers truths and discerns truth from opinion, as in the natural knowledge of God. Philosophy and scientific speculation are not autonomous, for reasoning to abstract levels of truth and to seek metaphysical questions integral to the philosophy of being requires courage and faith.[108] Any exclusion of metaphysics from the study of the physical universe denies the dependence of every creature upon God and subverts the meaning of human life and of all the universe. The created world is not self-sufficient.[109]

Certain and rapid advances of scientific knowledge in the physical and biological world have led to a fragmentation of knowledge. The unity of the entire story is gone and only a set of facts and theories remain to interpret the world, a condition which separates the human from the transcendent.[110] In reality, to study order there must be order and direction within the reason for intelligence is not confined to observable data alone, but can with genuine certitude attain to reality itself as knowable.[111] In this way, reality and truth transcend the empirical and factual data in a metaphysical dimension.

Newman:

His Holiness has reinforced the modern distinction between *scientia*, or scientific knowledge, and *sapientia*, the wisdom of metaphysics.

Whewell:

What of pure mathematics and quantum theory, where only what is observable and measurable can be truly known and where unity is of the observer and the observed phenomenon?

John Paul II:

The boundaries of the physical world are not analytical; they are metaphysical, and they are grounded in questions which have been pondered since the beginning of time.[112] Within scientist and non-scientist alike, there exists a capacity to encounter reality and being and to know truly the metaphysical dimension of truth. It is found beyond phenomenon and experience in the unified vision of knowledge, in God.[113] This belief is the essential element of sincere and authentic dialogue and the call to unity; to believe otherwise is an impoverishment of human thought. The expanding knowledge of the awesome mystery and dynamic work of the created universe, from the molecular to the cosmological, enjoins scientists to combine their search for scientific truth of the finite with the metaphysical truths of the infinite. This is a continuing search that aims for that which is beyond and higher; and in that quest will expand the mystery and humanity's vision of God.

Whewell:

Professor William Wallace has connected the long history of faith and science.[114] Professor Charles Taylor has contrasted the past five centuries of the necessary encounter of religion and society in a secular age.[115] This takes us up to the moment of the illuminating and historic 1999 debate between physicists Sir John Polkinghorne and Nobel laureate Steven Weinberg, on the new scientific evidence for design in our expanding universe. It was sponsored by the American Association for the Advancement of Science.[116]

Thus, discovery wins the wager and dialogue is the remedy of the prophetic and symbolic breaking of the circle of birth, death, and eternity.[117]

> Shee, who by making full perfection grow,
> Peeces a Circle, and still keeps it so...
> —*The Second Anniversary*[1612]
> by John Donne[118]

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Endnotes:

1. Donne, p. 73, lines 205 and 213.
2. Whewell, *On the Philosophy of Discovery*, p. 354.
3. Ibid., p. 358.
4. Whewell, *Indications of the Creator*, p. 171.
5. Ibid., p. 173.
6. Elkana, p. 381.
7. Aquinas, p. 76.
8. Burtt, *Metaphysical Foundations*, p. 165.
9. Ibid., p. 173.
10. Ibid., p. 193.
11. Fisher, p. 33.
12. Ibid., p. 70.
13. Ibid., p. 72.
14. Koyre, *From the Closed World*, p. 218.
15. Boyle, p. 460.
16. Hooykaas, p. 15.
17. Fisher, p. 164.
18. Kuhn, p. 6.
19. Ibid., p. 15.
20. Whewell, *On the Philosophy of Discovery,* p. 378.
21. Ibid., p. 383.
22. Ibid., p. 386
23. Burtt, op. cit., p. 223.
24. Burtt, *In Search of Philosophic Understanding*, p. 2.
25. Geometry signified matter. Burtt, *Metaphysical Foundations*, p. 30.
26. Ibid., p. 59.
27. Westfall, p. 2.
28. Burtt, op. cit., p. 83.
29. Ibid., p. 87.
30. Ibid., p. 113.
31. Ibid., p. 20.
32. Burtt, *In Search of Philosophic Understanding*, p. 314.
33. Ibid., p. 4.
34. Burtt, *Metaphysical Foundations*, p. 125.
35. Ibid., p. 129.
36. Ibid. Letter from Henry More to Robert Boyle (1665).
37. Burtt, op. cit., p. 150.
38. Boyle, p. 36.
39. Ibid., vol. IV, p. 460.
40. Ibid., vol. V, p. 150.
41. Burtt, op. cit., p. 305.
42. Liang, p. 19.
43. Lovejoy, p. 54.
44. Burtt, op. cit., p. 223.
45. Newton, p. 314.
46. Koyre, *Metaphysics and Measurement*, p. 90.
47. Koyre, *The Astronomical Revolution*, p. 119.
48. Brewster, p. 532.
49. Burtt, op. cit., p. 237.
50. Ibid., p. 240.
51. Ibid., p. 259.
52. Ibid., p. 284.

53. Ibid., p. 293.

54. Whewell, *Indications of the Creator*, p. 151.

55. Ibid., p. 156.

56. Koyre, *Newtonian Studies*, p. 53.

57. Koyre, *From the Closed World*, pp. 2, 276, 203.

58. Cosslett, p. 17.

59. Collins, p. 350.

60. Newman, Discourse IX, p. 168.

61. Ibid., Lecture IV, p. 169.

62. Newman, *Christianity and Physical Science*, p. 323.

63. Conway, pp. 289-90; Ashley, p. 1.

64. Newman, Discourse IX, p. 172.

65. Newman, *Christianity and Physical Science*, p. 321.

66. Collins, p. 370. Translated as "heart speaks to heart."

67. Ibid., p. 370.

68. Morley, p. 197.

69. Newman, *The Idea of a Liberal Education*, p. 162.

70. Ibid., p. 165.

71. Ibid., p. 169.

72. Ibid., p. 158.

73. Newman, *The Idea of a University*, p. 347.

74. Whitehead, *Essays in Science and Philosophy*, p. 109.

75. Ibid., p. 118.

76. Ferré, p. 265.

77. Whitehead, *The Concept of Nature*, pp. 8, 185, 189.

78. Whitehead, *Science and the Modern World*, p. 3.

79. Ferré, p. 266.

80. Whitehead, op. cit., p. 26.

81. Whitehead, *Religion in the Making*, p. 141.

82. Whitehead, *Science and the Modern World*, p. 63.

83. Ibid., p. 82.

84. Macklem, p. 107.

85. Donne, p. 44.

86. Barbour, p. 285.

87. Ibid., p. 287.

88. Ibid., p. 291; Shannon; Wiener.

89. Gribbin, p. 174.

90. Meyer, p. 137.

91. Polkinghorne, p. 77-78.

92. McMullin, pp. 49-79.

93. Ibid., p. 46.

94. Augustine, p. 234.

95. Russell, Stoeger and Coyne, *John Paul II on Science and Religion*, p.16.

96. John Paul II, *Fides et Ratio*, p. 341.

97. Aquinas, p. 760.

98. John Paul II, op. cit., p. 324.

99. Aquinas, p. 61.

100. John Paul II, op. cit., p. 331.

101. Ibid., p. 333.

102. Ibid., p. 326.

103. Ibid., p. 327.

104. Ibid., p. 329.

105. Aquinas, p. 64.

106. John Paul II, op. cit., p. 334.

107. Ibid., p. 335.

108. Ibid., p. 337.

109. Ibid., p. 339.

110. Ibid., p. 339.

111. Second Vatican Council, p. 14.

112. John Paul II, op. cit., p. 341.

113. Ibid., pp. 340, 342.

114. Wallace, pp. 1-44.

115. Taylor.

116. Goldberg.

117. See Manley's commentary on "The Anniversaries," in Donne, p. 46.

118. Donne, p. 107, lines 507-508.

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Ethics in the Context of Evolutionary Naturalism

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The author explores the contributions of three biologists—Ernst Mayr, E. O. Wilson, and Lynn Margulis—to evolutionary theories of ethics. In particular, how does each relate his or her view of ethics to naturalistic and humanistic philosophies? A humanistic ethic could lead to appeals to some sort of "transcendence" that is scientifically suspect. Naturalistic ethics, on the other hand, could lead to a sterile view of human culture. Can these two be brought together into some kind of naturalistic humanism? This essay presents some initial steps in this direction, based on a survey of the thought of these scientists.

Introduction

There are currently a number of significant voices in the biological community asserting some form of evolutionary philosophy. Ernst Mayr has proposed an evolutionary humanism; his former student, E. O. Wilson, propounds something more akin to an evolutionary naturalism. Lynn Margulis also seems to support some kind of evolutionary naturalism. I will explore here various aspects of these three biologists' philosophies, with an eye toward a constructive proposal of my own that falls in the general vicinity of evolutionary philosophies.

An initial definition of terms should shed some light on the direction to pursue in the more constructive phase of this work. In laying out the linguistic groundwork, recourse must inevitably be made to the actual philosophies offered by Mayr, Wilson, and Margulis. This initial step is two-fold: to be clear on what is meant, and to examine what each of these biologists is proposing. With this foundation firmly in place, each of these authors may be examined in turn, exploring the particular use to which each puts the rubric of evolution, and how each justifies this usage. At that point, it will be important to ask two questions. In the first place, where does each thinker find justification for his or her philosophy? And secondly, is the evidence convincing that these authors can, in fact, find justification for their philosophy where they think they can? This analysis will hopefully indicate which paths are most promising for the constructive phase of this project.

A preliminary caveat

An important question comes quite naturally out of this second stage of the inquiry. If some, or all, of these authors cannot find justification for their ethical program where they think they can, where does their justification come from? It is not the case that they do not justify their claims; they do, precisely because they want them to have a normative authority. Yet, if this authority comes not from evolution, where does it originate? This question embodies the most significant philosophical problem for each of these evolutionary philosophies. How it is answered, I claim, makes all the difference in the world.

In arguing for a strictly evolutionary justification, any ethical program must either fail or be radically redrawn in ways that

make some people quite uncomfortable (relativistic post-modernism qua science). But if an external source for authority is admitted, would that not undermine the very objective of these philosophies, which is to provide a scientific account of how humans should exist in the world—that is, a naturalistic ethic? Perhaps not, as both Mayr and Wilson seem quite ready to recognize that human behavior is not entirely reducible to natural scientific accounts. Clearly, human behavior must be consonant (to use a popular "science-and-religion" term) with a natural science description. That is, human behavior is constrained in important ways by the laws of biology, the laws of chemistry, the laws of physics, and finally the laws of quantum mechanics, as we know them. But this does not mean—and Mayr expresses this quite nicely—that human behaviors can be entirely explained, say, in terms of chemical laws. So, what *does* it mean? In terms of evolutionary philosophies, it means that one can claim that ethical imperatives do not derive solely from the way molecules interact, nor (more relevantly) from the way natural selection works. One can also justifiably claim that evolutionary epiphenomena, such as culture, can provide principles to guide ethical behavior.

Of course, the preceding does need further explication. Wilson, for example, might be inclined to assert a stronger link between culturally motivated ethical systems and natural selection.[1] While natural selection does not provide the raw material of ethical thought, it certainly constrains it. Or better, it acts on it. For Wilson—and for Mayr, for that matter—ethical systems are selected for.[2] Culture, then, is a source of novelty, but evolution is the ultimate arbiter of which ethical systems will survive.[3] A second point is that identifying culture as a possible justification for philosophical systems opens the can of worms alluded to earlier: post-modernism. Wilson's response, just outlined, is one attempt to avoid this slippery slope: no need to descend into the hell of a thousand equally valid ethical systems, thanks to the selective power of evolution. All philosophies are not equal; some systems survive and some do not. Those that do, succeed because, in some sense, they are better—better adapted or suited to their environment. The clever post-modernist should not despair, however: Wilson's thought on this subject is not the last word. The appeal to evolution does not allow anyone to say, in any ultimate sense, that one philosophical system is better than another, simply by the fact of its existence. After all, isn't it true that evolution does not make value judgments? Species *x* cannot be said to be "better" than species *y*, except with the all-important tag, "for a given environment." So, basing a philosophy on evolutionary concepts seems to lead to an interesting quandary: Does it allow strong normative claims to be made? Some believe that it does—or, at least, that it allows *strong-enough* claims. Others turn, whether they acknowledge it or not, to alternative sources. And where are such alternative sources to be found, with the authority to allow normative claims?

Definition of terms

Mayr identifies his ethical project with that of the nineteenth-century evolutionist, Julian Huxley. Mayr terms this perspective "evolutionary humanism." According to Huxley, this is "a belief in mankind [sic], a feeling of solidarity with mankind, and a loyalty toward mankind."[4] Of course, such a feeling of solidarity could have any number of underlying sources. Huxley explicitly chose biological evolution as his foundation:

> Man is the result of millions of years of evolution, and our most basic ethical principle should be to do everything toward enhancing the future of mankind. All other ethical norms can be derived from this baseline."[5]

In aligning himself with Huxley, Mayr affirms evolution as the baseline from which all particular ethical norms can be drawn. It is important to ask, given Mayr's affinity for

Huxley's humanism, if he also shares Huxley's overriding belief in progress.[6] If so, what might this mean for his evolutionary interpretation of ethics? Mayr's version of evolutionary humanism will be pursued in more depth below.

Evolution.

I begin with this term, because it seems this might be the easiest to define. After all, it is used quite often in everyday language, so it might be expected to have a clear meaning. What is meant by this term, in the context of either evolutionary humanism or evolutionary naturalism as an ethical system? Does it imply that an ethical scheme will be dynamic—always in flux in response to the changing conditions in the environment of humankind? And to be clear, what is meant by *humankind*? Is the focus at the level of individuals, of societies, or somewhere in between? Or perhaps by *evolution* we have in mind the idea that our ethical systems have evolved through the process of natural selection. Should this be taken literally, that is, in a strict biological sense? Or would it be preferable to assert that ethical systems evolved through a process of cultural evolution? In thinking further about the normal usage of this term, it becomes clear that the concept of *evolution* is polysemic, which often leads to confusion. I shall sort through some of these various meanings and attempt to determine what Mayr, Wilson, and Margulis mean by the term, *evolution*.

Actually, in turning back to these authors, the task should be greatly simplified. All three are biologists who are quite familiar with the theoretical content of evolution, and so should be clear in their use of it. All three would, I believe, argue that by using *evolution* in their ethic they do mean to say that the ethical system is dynamic. "Significant groups"—that is, a group with a unique identity by virtue of their shared values—create their ethical systems in such a way as to respond to the world around them. Given sufficient changes in their environment, any particular set of ethical beliefs can reasonably be expected to change as a result. I justify this claim by recourse to the second possibility noted above. All three authors would also agree that ethical systems have evolved through the process of natural selection. This is precisely why any ethical system would be expected to change, in response to dramatic environmental changes. They would have to; if they no longer were suited to the environment, they would simply disappear. They would be selected against, in favor of more adaptive systems.

A lot has been claimed here, and it might be wise to explicate some of it, before moving on. In the first place, some, and perhaps all, of the authors would not want to make a strong claim regarding the evolution of ethical systems. Secondly, as already indicated, the definition of *evolution* needs to be clarified. Is strictly biological evolution under consideration here, or also cultural evolution?

Basing a philosophy on evolutionary concepts seems to lead to an interesting quandary: Does it allow strong normative claims to be made? Some believe that it does, or at least that it allows* strong-enough *claims.

All the authors would acknowledge the existence of cultural evolution. In fact, all three have argued for a significant role for cultural evolution in the development of such phenomena as religion and ethical systems.[7]

That is not to say, however, that these cultural institutions have developed independently of biological evolution. (This is an important point that will be developed further.) What does this relationship between culture and biology tell about their views on the evolution of ethical systems? These systems are seen as the joint product of what Wilson calls "gene-culture evolution" and elsewhere has been called "bio-cultural evolution.[8] But regarding the ethical systems under consideration here—evolutionary humanism or naturalism—there is a surprising emphasis on the cultural. This is important in understanding why Mayr, for example, would be unwilling to make a strong claim about the evolution of ethical systems. Mayr states, "Evolution does not provide us with a codified set of ethical norms."[9] The strong claim being rejected here is not that natural selection does not act on ethical systems, but rather that evolution does not provide the specific ethical system being selected for. This is a crucial distinction in what is meant by evolutionary humanism/naturalism.

By formulating their ethical systems in the context of evolutionary theory, none of the authors makes the claim that biological evolution can provide a complete explanation for human moral behavior. What they assert is that evolution, understood now simply as directed by natural selection, constrains ethical systems in significant ways.[10] Specifically, if an ethical system becomes too far removed from the kinds of ethical situations people find themselves in, it will no longer be effective in helping them make good decisions and, so, will necessarily give way to systems that are more suited to the environment. What is important to recognize in this argument, however, is the unstated assertion that, despite all the power that human beings seem to have, biology is still the ultimate arbiter of what will exist and what will not. The biological part of bio-cultural evolution plays the role of selection. The cultural part plays the role of mutation.[11] Culture provides the novel ethical norms to put to the test. Of course, culture does have some selective power in determining which of these novel principles get put into widespread usage; but this is only on a short-term timescale. On a truly evolutionary timescale, biological selection is the master of the game. It would seem, then, that, for these authors, *evolution* refers more properly to biological processes than cultural ones.

Humanism and naturalism.

These terms might be easier to specify. The kind of *humanism* espoused by Mayr (after Huxley) represents what in religious circles has come to be known as anthropocentrism. Recall Huxley's words:

> Our most basic ethical principle should be to do everything toward enhancing the future of mankind.[12]

Mayr's is a vision of human beings as the pinnacle of the world, responsible in unique ways for the well-being of the planet. He writes,

> Every generation is the current caretaker not only of the human gene pool but indeed of *all nature* on our fragile globe.[13]

Mayr's ethic is based on the idea that survival of the human species is paramount. That our species should be concerned for the rest of the planet reinforces this primary concern; If too much of the world is destroyed, we put their own future in serious jeopardy.

The relation to evolution should be clear. When Mayr asserts an ethic based on evolutionary humanism, he has in mind two things. First of all is the kind of evolutionary reading of ethics outlined previously. If an ethical system drifts too far from the kinds of normative prescriptions that allow us to thrive in our environment, it will be forced into extinction, in favor of a new scheme. Mayr's environmental concerns are based on this kind of reading. He interprets contemporary Western society as dangerously out of balance with the environment. Thus, a particular ethical system will be selected against, unless it is able to adapt itself to the

realities of environmental degradation. This leads directly to Mayr's second idea: if we do not change our values, that is, change the way we make ethical decisions, we will become extinct. It would seem that selection can be seen acting at various levels: there is selection for ethical norms, and there is the more "basic" selection, simply for survival. Ethics, then, can be given a direct evolutionary reading as an adaptive characteristic of our species.

The question remains: What does *humanism* refer to, in Mayr's evolutionary humanism? From what has just been said, it would seem that it is intended to represent an ethical system based in biological evolution (with appropriate nods to cultural evolution) that seeks to maximize human well-being. With this as its base, it then branches out to non-human aspects of the world, with the intent of identifying our proper relations to them.

It is interesting to note that while *humanism* refers to an emphasis on humanity and human values, *naturalism* does not refer to an emphasis upon nature. A humanistic philosophy can also be naturalistic, and vice versa. The "nature" in *naturalism* is getting at something else. What this is, however, is rather complicated. Willem Drees, drawing on the work of Peter Strawson, asserts that there are at least two ways of using the word, *naturalism*. On the one hand, there is *soft naturalism*. This is what is meant when a painting is refered to as *naturalist*. It refers to "what we ordinarily do and believe as humans, say about colours, feelings, and moral judgements."[14] On the other hand, there is *hard naturalism*. This is the naturalism that tries to explain human beings in objective, scientific language. It is the attempt to explain human behavior as if it is like any other phenomenon in the natural world.

Given these two definitions, how would one characterize these three authors? Are they soft or hard naturalists? Wilson might be easier to identify clearly. Drees points out that hard naturalism is often developed in terms of the scientific method. In doing this, one is committing oneself to the view that no things exist that, in principle, lie outside the scope of scientific explanation.[15] This vision seems similar to what Wilson exhibits in *Consilience*: we may not *yet* be able to give a scientific account of every aspect of human beings and the world, but we should be able to at some future point. What about Mayr and Margulis? Margulis certainly seems to be entertaining a similar idea when she interprets religion as an evolutionary adaptive phenomenon for increasing group cohesion.[16] Likewise, Mayr gives religion an evolutionary role. But does giving religion or ethics an evolutionary interpretation mean that their possibilities have been exhausted? Yes and no. Mayr hedges his bets on this score, and this may explain why he, of the three authors, is the one who asserts an evolutionary humanism. Margulis is much closer to Wilson: while religion and ethics can be discussed at a "higher" level, in important ways all the significant points that need to be made are part of a physicalist-level account.

Mayr interprets contemporary Western society as dangerously out of balance with the environment. Thus, a particular ethical system will be selected against, unless it is able to adapt itself to the realities of environmental degradation.

If this characterization of the three authors is accepted, then perhaps I was too hasty in flatly stating that *naturalism* does not refer to an emphasis on nature in a way analogous to humanism's emphasis on the

human. It might now be possible to say that the import of defining an ethical theory as coming from a position of evolutionary naturalism is that this ensures that one cannot make recourse to something outside of nature as the ground, or justification, for a theory. It is clear that this would represent the "strong naturalist position." Ethical systems are not just constructed to look like the natural world; they are wholly entailed by it.

In saying this, the discussion of the use of the term *evolution* must be born in mind. By asserting that ethical systems are wholly entailed by the natural world is not to say that the world provides a well-defined set of norms on a silver platter. Culture does make significant contributions to the possible realm of ethical practices, but these ethics must be accountable to the "rule of nature." An ethical system that does not tell us to act in ways that will allow us to survive will not *itself* survive. Either it will be replaced by a system that is better suited to the environment, or we, as its physical manifestations, will perish. Intriguingly, this is a return to Mayr's view of ethics. The major difference between the evolutionary humanist position and the evolutionary naturalist position does not seem to lie in the idea of nature as a constraint on ethics. What, then, is the difference? I look to the three authors for answers.

Mayr tries to walk the fine line between being able to give an evolutionary account of ethical behavior and saying that there is something unique about what we do when we act ethically.

Ernst Mayr

Mayr's evolutionary humanism has already been discussed, with its ties, for him, to an environmental ethic. In this section, I explore his argument in more detail, with a particular eye toward answering the question, Where does Mayr believe the justification for his ethic comes from? Having presented this, I will turn to the question of whether to accept his account of things.

It is worthwhile to ask whether Mayr's evolutionary humanism is really a form of naturalism, or whether his desire for an anthropocentric focus ultimately force him in a different direction. The possibility of being both a humanist and a naturalist has already been noted. The reason for asking this question directly of Mayr, then, has to do with his justification for being so human-centered. The question could be rephrased this way: Is it possible to assert a strongly humanist ethical program that remains firmly grounded in naturalistic explanation?

Mayr lays out his philosophical task in constructing an evolutionary humanist ethic by identifying what he believes to be the central problem for any kind of naturalistic ethic: How can the existence of altruistic behavior in humans be accounted for, given the intrinsic human egocentrism that is so often assumed by evolutionary theory? To begin addressing this question, Mayr finds it necessary to parse *altruism* into three categories: inclusive fitness altruism, reciprocal altruism, and genuine altruism. From the name given to the third category, one can anticipate that Mayr intends to make value judgments about them. In fact, what he does is to argue for a hierarchical structure of altruism. This hierarchy fits neatly into his evolutionary account, as he frames the altruism categories in language taken from evolutionary theory. One might even be led so far as to see these various forms of altruism as emerging in ascending order, as one moves from less social to more social animals.

Two strands of Mayr's ethical thought can be discerned in this division. He is clearly trying, first of all, to provide an evolutionary account for the origin and the development of ethics. Thus, he firmly plants himself in the naturalistic camp—and not just the soft kind of naturalism, but hard naturalism. It seems undeniable that Mayr wants, at least at some level, to give ethics a naturalistic explanation. What this level is and where it ends will be of interest as I inquire into the question of the justification of his project. The second strand to highlight in Mayr's thought is the influence of Huxley, mentioned above.

These are not just three *different*, but intrinsically *equal*, forms of altruism. Note the names. The first two draw upon evolutionary language. The third, where he wants to locate what is traditionally thought of as human altruism, is dubbed *genuine* altruism. Interestingly, Mayr's move to distinguish between the first two and the third simultaneously accomplishes two things. First, it allows him to make the claim that human altruism (generally of the third kind) is not just selfish action disguised in fancy clothes. When altruistic acts of the third kind are performed, a person makes a genuine sacrifice simply for the sake of, say, compassion. Such an action cannot easily, or in a straightforward fashion, be explained away as a form of hidden selfishness.

This analysis might be acceptable, by and large. After all, when constructing an ethical system, one wants to be able to say that at least some actions are not done solely for the rewards they will give. At the same time, genuine altruism forces the question of what happened to the naturalistic explanation. Has Mayr gone too far in his claim about genuine altruism? Can he say that it is qualitatively different from types one and two, but still claim to be able to account for it naturalistically?

Mayr does not actually want to make a grand distinction between genuine altruism and the other forms. He seems to recognize precisely this danger of undermining his own explanatory framework, if he drives the wedge too deep. So how exactly does he distinguish what it is that we human beings do in our moments of ethical greatness? One of Mayr's key points is that genuine altruism is a form of ethics; the others are not. In order for there to be ethical behavior, there must be a capacity for choice that does not, according to Mayr, exist in much of nature other than humanity. This is his first point. His second point is that genuine altruism is an expression of this ability to choose. In genuine altruism we, in a way, transcend our biology.[17] This is a problematic concept and one to return to later. For now, Mayr sees examples of the transcendence of biology in such actions as choosing to cooperate with a group larger than one's kin, for the welfare of the extended tribe. In this way, Mayr tries to walk the fine line between being able to give an evolutionary account of ethical behavior and saying that there is something unique about what we do when we act ethically.

Mayr should be applauded for this balancing act. Quite often in naturalistic explanations, the world is flattened into an uninteresting, desolate landscape. Rather than confining themselves to descriptions of the evolutionary origins of ethical impulses, such explanations encompass all ethical behaviors in a monistic, physicalist language. Such description is uninteresting, because it claims there is nothing else to say about ethical behavior other than, for example, what the neurophysiologist says about brain chemistry. Mayr is attempting something much richer, something that also takes a lot less hubris. He openly states that his evolutionary humanism must appeal both to the natural sciences and to the humanities. As a result of this dual emphasis, Mayr does not believe his evolutionary humanism can be derived strictly from biological evolution. What is important to him, however, is that his ethical system be consistent with biological evolution in ways that

traditional ethical systems, which he claims do not take biology into account, are not. One could, perhaps, ask if Mayr weights biology and culture equally. I suspect that he does not.[18] He is asserting an evolutionary humanism. Evolution comes first. This represents a certain commitment, as a scientist, to the epistemic values of science that give it a pride of place among truth-claiming enterprises. Traditional ethical systems are insufficient, not just because they do not consider the possible contributions of evolution—nor neurophysiology, for that matter. Rather, they are insufficient, because in not taking these contributions into account, traditional ethical theories are somewhat ethereal: they hover above the head, instead of rooting themselves firmly in the body. The only way so to root ethics is to listen to what the sciences have to say about human constitution, and to figure out in what ways this constrains the possibilities for ethical theory.

So where does Mayr place the justification for his particular ethical system? As noted above, Mayr does seem to be attempting to construct a genuinely naturalistic ethic. Mayr himself states that evolution alone does not give a structured ethical system. Thus, by necessity, he must go elsewhere to flesh out his system fully. He still wants his ethic to be naturalistic, however. In order to see how successful he is in making it so, one should not ask whether or not he imports anything from "outside" evolution, but rather, how consonant his final theory is with evolution.

Mayr's claim would be that his evolutionary humanism, with its strong environmental component, is very consonant with evolution. Is he correct in his claim? Mayr uses the language of "rights" when defending the environmental portions of his ethic. It is his claim that humans have no right to destroy other species.[19] The sheer fact that a species has come into existence through the process of evolution tells him this. But is this claim consonant with evolution? Species do become extinct; there are rather extensive records of animals that no longer exist. Did the meteoroid that is hypothesized to have wiped out the dinosaurs have no right to do that? This seems an odd use of language.

There are at least three possible explanations for such language with respect to human activities. The first possibility is that perhaps Mayr desires a steady-state environment for the world today. After all, given his progressivist tendencies, he might think the world has reached an optimum state with the evolution of human beings. However, this vision is not very indicative of the history of the planet and would certainly create strong discord between his ethical vision and evolution. A second possibility is that Mayr does not object so much to the human extinction of other species in general, as to the astonishing rate at which it is occurring. This would be much more in keeping with his evolutionary views, and seems more likely. A final possibility is that, perhaps, by invoking the language of rights, he is making a self-referential argument. When he asserts that we have no right to destroy other species, he is not supposing the existence of a trans-species ethical system that human beings, as all other animals, are subject to. Instead, he is simply saying that we are ethical beings; and, as such, we should recognize that what we are doing, in pressing other species into extinction, is unethical. While this possibility presupposes his ethical concerns, it is a promising idea. (It also points toward the perspective of Lynn Margulis.) According to this third possibility, it could be said that Mayr's ultimate justification for his ethical system lies in a transcendent human capacity—namely, the ability to choose one's actions. With this freedom as a given, Mayr sees ethical systems as justified by the presence or absence of a harmony between the choices we actually make and the constraints of evolution. While he would certainly argue that his ethical system is justified by this account, others might counter that, in the end, his emphasis on human well-being undermines it.

E. O. Wilson

Straddling the board between evolutionary humanism and naturalism is Edward O. Wilson. Since he was a student of Mayr's, it

is not surprising to find some similarities between the two. Both are ardent environmentalists, and, for both, this care for the world is expressed in their ethical system. They also share a belief in the epistemic power of science as uniquely able, among all human intellectual endeavors, to reach knowledge about how the world "really" is. For Wilson, however, the proper approach to ethics is empiricism. Juxtaposing this approach to transcendentalism, which bases its claims of authority on some unchanging truth beyond the realm of the natural world, Wilson asserts that the roots of ethical systems lie in the natural world. This being the case, science is at least a natural ally in the search for ethical foundations, and perhaps even the most skillful one.

In setting out this contrast between the transcendentalist and empiricist schools of ethics, Wilson makes a fine distinction between ethics and moral behavior. In a sense, morals are how we describe what we do. Ethics represents a systematic reflection upon these actions, and a codification of them. Morals are behaviors; ethics are theoretical structures. The two are not unrelated. According to Wilson, the biological roots of moral behavior can be empirically explored, "explaining their material origins and biases." [20] Morals, then, provide an entrée into the empirical examination of ethical systems, since ethical systems represent the social codification of such biologically motivated behaviors. Thus, both morals and, through them, ethics are open to scientific investigation and, hence, naturalistic explications.

In fact, Wilson makes the far stronger claim that not only are morals and ethics open to scientific investigation, the results of these investigations, if utilized properly, lead to the development of stable ethical codes. This aspect of Wilson's vision of the project of ethics is strikingly similar to Mayr's. An evolutionary ethical system provides the best available ethical system, because it employs the "fundamental" knowledge of the sciences as its foundation. One might be suspicious that this is a flirtation with the naturalistic fallacy: Mayr and Wilson both seem very close to asserting that the moral behaviors we "naturally" embody should be accepted, without question, as the correct moral position for developing an ethic. I have already shown that Mayr does not want to make this assertion, so he should be excused. Wilson, however, is quite happy to take this direction. He refutes the validity of the naturalistic fallacy by arguing that if Kant, Moore, and Rawls had had the benefit of modern biological reflection, they would not have thought the way they did. One should, perhaps, hope that Wilson, with this attitude, is closer to the naturalist end of the scale than the humanist end. An explicitly anthropocentric ethic like Mayr's, combined with a rejection of the naturalistic fallacy, could quickly devolve into an instrumentalist view of nature. We know that Wilson is an environmentalist; so the question becomes why. Is it only because human beings need the planet for their own existence?

Mayr and Wilson both seem very close to asserting that the moral behaviors we "naturally" embody should be accepted, without question, as the correct moral position for developing an ethic.

Wilson does, in fact, seem to argue in this direction. But for him, this is entirely in keeping with his desire to construct an evolutionary ethic. He endorses what he terms a "naturalistic self-image" of human beings, balanced on a razor's edge—the "biosphere within which a thousand imaginable hells are

possible but only one paradise."[21] Our actions are threatening to knock us off this razor's edge—or rather, they are threatening to destroy the razor altogether. Thus, when we argue for an environmental ethic, we are doing so for selfish reasons. It seems that, in the end, Mayr's third form of altruism, "genuine altruism," is wrong, and that natural selection ensures that our ethics, in the long run, work for our benefit.

Does this mean that there is a correct ethical system for the world today? The answer to this question depends on which level of description is engaged. Wilson, like Mayr, makes certain claims about the relation of culture to biology. While physicalistic mechanisms, in general, can be discovered that select out broad behavioral characteristics for our species, these characteristics often, or perhaps always, find unique expression through cultural systems. Ethical systems are not simply by-products of biological evolution, but they do need to be properly understood—that is, they must be understood as based in our genetic heritage, in response to the environment. This proper understanding is at the heart of Wilson's contrast between empiricist and transcendentalist ethics. By appealing to justification outside the natural world, the transcendentalists are committing themselves to something that is unacceptable to Wilson and his naturalistic agenda: a special realm closed to the epistemic power of science.

As for a correct ethical system for the situation today, Wilson would probably argue for multiple ethical systems. Each would be a product of its unique cultural milieu, but underlying the many differences would be an essential core, comprised of certain genetic behavioral tendencies and the fact that overpopulation is threatening the survival of our species. These are not the only possible ethical systems; certainly there are others that are arguably driving the continued degradation of the environment. Wilson would argue that these evolutionary ethics are the only viable ethics for our continued survival.

What can be said about the justification for Wilson's ethical vision? Even more so than Mayr does, Wilson seeks to establish the roots for his system in evolution. For both authors, evolution does not simply give us ethics on a silver platter (although, for Wilson, it may be slightly more able to do so). The interaction of culture and biology is what generates ethical systems. The justification for any particular ethical system is grounded, however, in evolutionary criteria. Cultures can choose their ethics, no doubt. The argument is that what constitutes a "good" ethical system is its ability to make human beings adaptive. If this sounds a bit impersonal, Wilson points to culture, which puts different faces on this essentially adaptive system. His emphasis on the existence of such naturalistic criteria for what makes an ethical system "good" undermines Mayr's idea that evolution does not give us a preset ethical code. Nature does, in fact, seem to provide a list of precepts. These may be modulated by culture, but for Wilson, at least, they are there, below the surface, waiting to be discovered by empirical investigation.

One of the outcomes of this kind of strong naturalistic program does, however, seem to be a human focus. Ethical systems should emphasize our well-being, because that is their purpose. Ethics, in the systems of both Mayr and Wilson, arose for the purpose of group cohesion. Ethical systems are adaptive. They are intended to help us survive and thrive. Does this mean that an evolutionary ethic is more suited to being humanistic than strictly naturalistic? Lynn Margulis may shed some light on this matter.

Lynn Margulis

At the outset of a discussion of Margulis' thought, it should noted that talk of evolutionary naturalism or humanism is foreign language. These are not terms that she uses to describe her position; however, I think a strong case can be made for using them in talking about her views on ethics.

In order to understand Margulis' views on evolution, it is necessary to bring in the concept of symbiosis. This can be described in a bare-bones manner as the living together in physical contact of life-forms of various species.[22] Margulis makes the claim that most life, perhaps even all life, tends to exist symbiotically. This idea leads her to have certain affinities for James Lovelock's Gaia Hypothesis. Although Margulis considers the kind of New Age nature spirituality that has built up around the Gaia Hypothesis to be anathema, she insists that on its own, it is a scientific theory. Indeed, it is a theory quite similar to her own idea of a symbiotic planet. As one of her students once pointed out, Gaia is symbiosis as seen from space.[23] In order to understand how the two fit together, the bare-bones description of symbiosis will have to be filled out slightly. When Margulis says that symbiosis entails the living together of species in physical contact, she does not restrict this to *direct* physical contact. All life on the planet is in physical contact through the exchange of gases in the atmosphere. Taken as a whole, then, the earth represents a vast symbiotic system: Gaia. In claiming that all life exists symbiotically, Margulis is not asserting that symbiosis is *necessary* for life, but rather that it is a *part* of life. A single organism on its own may once have been able to survive; but, given the sophistication of the biosphere today, no single organism can go it alone. All are locked together in ever-expanding, interconnected spheres of interdependence.

By appealing to justification outside the natural world, the transcendentalists are committing themselves to something that is unacceptable to Wilson and his naturalistic agenda: a special realm closed to the epistemic power of science.

At the same that she makes this claim, Margulis also asserts that no part—or parts—is indispensable to the continuation of life. This is the point at which to pursue Margulis' notion of ethics. She makes two claims that reverberate throughout her writing: no species is inherently more important than any other, and life will go on. The first of these should, at least on the surface, seem like a direct challenge to Mayr's evolutionary humanism. Against his progressivist views, which place *Homo sapiens* at the top of the heap in every way, Margulis suggests that if any life-form is going to be privileged, it should be bacteria. After all, they are the source of all other life, and they are the most likely forms of life to survive practically anything. From an evolutionary point of view, therefore, they seem to be the most important. But this view may just reflect a professional bias on Margulis' part. She also says that we should consider ourselves special. In fact, her emphasis on considering ourselves special is the most distinguishing feature of her ethical vision.

Her second claim, that life will go on, gives some hints as to what Margulis sees as the ultimate value. In her book, *Symbiotic Planet*, Margulis pokes fun at environmentalists who run around, calling people to action with the battle cry, "Save the planet!" What hubris this is! We cannot save the planet. We do not *need* to save the planet. The planet will take care of itself. What we need to save is *ourselves*. And what we need to save ourselves from is...ourselves. Like Mayr and Wilson, Margulis seems to be concerned with the "environmental crisis." Also like Mayr and Wilson, Margulis thinks that it is important for us to stop our destructive actions. But for Margulis, we do not need to do this because we have no "right" to kill

other species. Since no species is intrinsically any more important than any other, if the Florida panther is to be replaced by green slime mold, so be it. If we are to make any kind of ethical argument for why we should save the Florida panther, we had better recognize that we are doing it because we like furry animals more than muck.[24]

Margulis' vision of ethics is a two-tiered system. At one level, a particular ethical system ought to be such that it does not lead us to a change the environment so much that we are no longer suited to it. If it does direct us to change our environment to such an extent, then, as Mayr and Wilson would agree, natural selection will chose against that system; and if we are unwilling to modify it, then we as a species will go down with our ethics. Notice, however, that much of the value-laden language found in Mayr or Wilson is absent in Margulis. It is not that we might *destroy* our environment, but, rather, that we will simply *change* it; and this could be so much the worse for us.

Margulis concludes that we are not that special, and if we become extinct, too bad for us. Nature does not care one way or another if we survive. What matters in the end is that "life" survives. Its form does not matter.

Margulis also offers a more immediate level of ethics—immediate in the sense of being close to commonplace understandings of how to judge behaviors. At this level, Margulis is quite happy to say that we choose what we want to value. These choices, of course, need to be in consonance with the level of natural selection. Like Mayr and Wilson, Margulis is not able to get away from the idea that the physical processes of the world constrain what goes on at "higher" levels. This constraining power, however, is somewhat less tightly formulated in her vision. She does not seem to view species loss as portending imminent doom for our species, who could survive without butterflies and tigers and warblers. The question for Margulis is whether or not we want to survive that way.

With the insistence that many of our most pressing ethical choices are based on our own vision of the kind of world we want to live in, Margulis seems to be closing a circle here. Beginning with Mayr's humanism, where questions arose as to how fully his project could be considered to be a naturalistic one, this analysis moved on to Wilson's work, with its emphasis on naturalism, which seemed to be moving back in the direction of humanism. Now, with Margulis, a thoroughgoing ethic based on evolutionary naturalism is again encountered, one that leads to a humanistic vision. This anthropocentrism, however, is not based, as Mayr's is, on a progressivist belief in the supremacy of human beings. Rather, it is based on an acknowledgement that if naturalism is to be taken seriously, we must recognize that we will inevitably focus on ourselves. This makes the formulation of normative ethical claims about how we should treat the environment a bit more difficult, but encouragement may be found in the fact that all of these authors feel strongly about changing the way in which we view the environment.

Where to go from here?

In beginning to develop some normative conclusions of my own, I would like to look more closely at some of the possible implications that a move from evolutionary naturalism to evolutionary humanism might

imply for the form and basis of an ethical system. Margulis' program develops some of these implications, but it is necessary to ask whether her conclusions are the only, or even the best, possible interpretation. As has been noted, Margulis pushes naturalism to an extreme. As a result, while her ethics are underpinned at a deep level by biological evolution, they become more open to cultural influences. This vision is not discontinuous with that of Wilson; for both, there is a sense of levels, with biological evolution forming the base and culture being a source of novelty. The main difference seems to lie in how closely Margulis and Wilson link these two levels. For Margulis, the levels are linked, but their connection is rather remote. Viable ethical systems can take a wide array of forms. The important question here is not whether a particular ethical system is viable biologically, but whether it is acceptable aesthetically or spiritually.[25] Culture becomes much more powerful for Margulis than for Wilson, not only generating novelty, but also representing a strong selective pressure, as an ethic is chosen based on the kind of world we want to live in. We human beings can say we are special, and we can generate ethical systems based on this idea; but ultimately this just represents our own preference. Margulis concludes that we are not that special, and if we become extinct, too bad for us. Nature does not care one way or another if we survive. What matters in the end is that "life" survives. Its form does not matter. Thus, while Margulis, by and large, would be considered an evolutionary naturalist, in terms of ethics she seems to be an humanist, given the role of choice in ethical systems. For Wilson, on the other hand, the connection between levels in ethics is much more tightly drawn. There is a limited range of viable ethical schemes, because the primary selective force is natural selection. Wilson makes much more of the fact that the range of survivable environments for human beings is preciously small—thousands of possible hells, but only one paradise. He tries to integrate his ethical humanism into a broader evolutionary naturalism. When we assert that our survival does matter, it is not just a case of expressing our desires—or rather, it *is* an expression of our desire, but this itself is given a naturalistic interpretation.

It is important to understand what is meant by this point. In many ways, Wilson's attempt to give a naturalistic interpretation of our desires leads him to a much more satisfying account of the relation between nature and culture. The careful construction of this relationship will help us in creating our own account of an ethical system based on evolutionary naturalism. Mayr has claimed that human beings have transcended nature through culture. Technological society has made us so powerful that, according to Mayr, it would no longer be correct to understand human beings as part of nature.[26] But if we are not a part of nature, what are we? To use the language of transcendence to imply that humans have somehow gained a measure of autonomy from nature makes sense only in a very limited way. Mayr himself acknowledges this. He claims the need to construct ethical theories in response to scientific knowledge about human being, because we are, in fundamental ways, products of physicalistic processes. At the same time, however, Mayr drives a wedge deeply between humanity and nature.

Interestingly, Margulis seems to wind up with the same divide. Despite her much more thoroughgoing naturalism, Margulis' emphasis on the arbitrariness of many ethical choices belies an underlying split between biology and culture. She acknowledges that, while humans may be capable of surviving in a world consisting mostly of brackish waterways and concrete, she thinks we should ask if this is the kind of world we *want* to live in. Her personal inclination is to answer "no": a world with trees and flowers, furry animals and clear water is more appealing to the human psyche, and even important to human spirituality. But this is as

far as she goes. Margulis does not tie these features of humanity into her evolutionary framework. Perhaps she should not be judged too harshly, as her interest in evolution is not in macroorganisms. But the conclusion is that, by not tying these elements into her naturalistic description, she comes away with an incomplete account of the relation of ethics to evolutionary naturalism.

This is where Wilson's grand attempt at epistemological synthesis, *Consilience*, comes into its own. Nothing is left untouched in Wilson's quest to argue for the possibility of a completely naturalistic account of the world. Art, religion, and ethics all come under his critical gaze, with the intent of showing that the humanistic fields that study them can also be brought into the general fold of scientific investigation. While one may agree or disagree with Wilson's assessment of the relationship between the humanities and the sciences, it seems undeniable that his argument is the strongest attempt to ground an evolutionary humanism in naturalistic explanation.

In doing so, Wilson seems to remove the distinction between biology and culture. That is not to say that he does not think that culture exists. Certainly it does. In fact, its existence is the driving force behind *Consilience*. As has been shown in the specific case of ethics, however, Wilson wants to reject the transcendentalism rampant in "traditional" accounts of human culture. All aspects of culture, he says, must ultimately be rooted in biology, a claim that causes many readers to recoil from his program. Such a naturalism often winds up being a "nothing but" kind of materialism. I do not think this is what Wilson wants to do. He is trying to close the gap between biology and culture, but he does not think culture can be explained away. One can still meaningfully talk about the beauty of a painting, even if the neural states that correspond to this feeling are thoroughly understood. The fear of biological reductionism is tied up with the fear of determinism. For Wilson, however, emergence is a genuine phenomenon. His naturalistic enterprise is predicated on the idea that the emergent property is real, and on the belief that it is constrained in certain ways by "lower" levels. Understanding these lower levels can give greater clarity when trying to understand the "higher" levels. Perhaps more troubling is Wilson's rejection of the naturalistic fallacy. Naturalistic arguments have frequently been used to support what we now consider to be unethical social doctrines. And, at a more abstract level, a rejection of the naturalistic fallacy can be seen to exacerbate the dichotomy between nature and culture: because things are biologically given to us in a certain way, we should not try to change them through social mechanisms.

So what does all this mean for an attempt to construct an evolutionary ethics? The important point to take from Wilson is that culture is not distinct from biology. So, when Margulis says that an ethical choice to try to preserve furry animals is just based on aesthetic considerations, the possibility of bringing this preference into a naturalistic account should be insisted upon. In doing so, a strong move toward a genuinely naturalistic evolutionary humanism would be made. Of course, this may actually be quite difficult to do. Despite Wilson's confidence that it is quite "natural" for humans to think that the "natural world" is beautiful,[27] one runs up against the difficult question of what constitutes the natural world. Is it the kinds of places set aside as National Parks? If so, does this designation not once again introduce the old split between humans and the rest of nature? This kind of vision of nature also opens up a host of social justice issues, because those in the developed West desire to preserve "pristine nature" not just in developed nations, but also in developing countries, often to the financial detriment of certain groups of their citizens.

Despite these difficulties, however, I do want to be able to make the assertion, in a naturalistic evolutionary humanism, that one

person's claim for superhighways and industrialization and another person's claim for land and species conservation can both be ethically desirable. It is in order to address this kind of question that I suspect that all three authors introduce the idea of levels into their discussions of ethics. By doing so, they can say that both of the aforementioned views represent ethical visions. But perhaps one of them is more viable by evolutionary criteria, because it is more advantageous to our survival. If so, this gives Mayr, Wilson, and Margulis the authority to make normative claims about which ethical system one should choose to follow.

Is this satisfying, or does it once again seem to make the naturalistic argument a reductionistic, deterministic physicalism? I would argue that it does not rob us of a role in determining our ethical vision, beyond merely being along for the ride. As evolutionists, all three authors recognize an important aspect about all life: by its very existence it transforms its environment. For Mayr, this is why human beings are set apart from nature. For Margulis, this is what gets symbiosis going in the first place. Regardless of the particular spin put on this environmental impact, it does have certain implications for the consideration of ethics. In response to the claim that an appeal to natural selection for a justification of ethical systems degrades ethics to the lowest common denominator, I appeal to the impact that particular ethical systems have on the world. Mayr, Wilson, and Margulis all recognize that such an evolutionarily viable ethic is realizable in multiple ways. But given this multiplicity, should it be assumed that, in the long run, they are all equivalent? This seems very unlikely. The point that is being pursued here is that, while it might perhaps be said that natural selection determines which ethical systems are viable, other selection criteria must also come into effect in choosing which ethic actually becomes manifest—or rather, since I wish to avoid a split between biology and culture, natural selection itself works in a multitude of ways.

What might these other selection criteria be? In order to answer this question, it would be helpful to review briefly. Evolutionary naturalism, a philosophy that has been evident in all three authors to a greater or lesser extent, provides the idea that any ethical system needs to be consonant with natural selection. Any system that allows us to approve of the rampant destruction of the natural world will ultimately be rejected by evolution, because we rely on the natural world for our survival. If we alter it sufficiently, we will find ourselves no longer suited to this altered environment, and we will be supplanted by a species better adapted. This would be a strict, naturalistic account of ethics. Two varieties of humanisms have been encountered. For Mayr, it takes the form of a progressivist vision of history that sees humans as the climax of evolution. For Margulis, humanism is restricted to the realm of ethics. Our species is not special, as seen from the perspective of evolution; we are special only from our own perspective. Both of these two varieties of humanism assert that our desires are paramount in the development of an ethical scheme. How each author arrives there, and

Cultural selection is not different from natural selection; it is natural selection operating through the historical contingencies of human cultural preferences.

how each interprets what this means, however, is quite different. But for the present purposes, it is their common emphasis on humankind that is important. By giving human beings a significant role in the selection of ethical systems, they help answer the question of what other selection criteria might exist besides natural selection: one of them would be cultural selection.

Having stated this so baldly, however, I realize that this is not where I want to go. I have been trying to avoid a split between biology and culture. In order to do so, I need to think in terms of a naturalistic evolutionary humanism. Naturalistic terms are needed, because biology really does tell something about what being human is. What about evolutionary humanism? Care must be taken not to interpret this in Mayr's progressivist way. Rather, evolutionary humanism can mean that humans are embedded in nature. We are evolved beings, and everything about us is part of nature. I do not want to assert simply an ethical humanism akin to Margulis'; this is too dismissive of the fact that our desires to decide about the way the world is or should be are not just ours, somehow separate from nature. Human desires and motivations need to be incorporated into a naturalistic and evolutionary framework. If this can be done, then a meaningful response can be given to the question of the "otherness" of cultural selection criteria. Cultural selection is not different from natural selection; it is natural selection operating through the historical contingencies of human cultural preferences.

Thinking in this way is vitally important in the formulation of new ethical systems. In the split between biology and culture, there is a shift in timescales that threatens to make a strictly biologically selected ethic irrelevant. We may be significantly altering our environment too quickly for the more traditional kind of natural selection to respond to. We do not have the luxury of waiting for natural selection (in the limited sense) to tell us what is viable and what is not. We can look to natural selection as a guide—to see what, in general, seems to work and what does not; but in the end we must make the value judgment. Evolution does not make value judgments. Thus, there is even more reason to think that we should not look to a limited notion of natural selection as the arbiter of which ethical system to adopt. Evolution may play a nasty trick on us and "choose" against us. By finding a place for ourselves, culture and all, within natural selection, perhaps it can even be argued that evolution *can* make value judgements. If we value our survival, we can choose to adopt ethical systems that will favor our continued existence. In constructing such ethical systems, I have tried to argue that a naturalistic evolutionary humanism offers the best hope. Drawing on evolutionary naturalism's desire to collapse the separation between human beings and the rest of the world, a rigorous ethical system can be constructed that takes human being seriously. At the same time, however, it does not wash out our distinctiveness. We are, after all, human. As the actors in our ethical systems, we should take on a central role. By affirming that we are human beings, embedded in the world, naturalistic evolutionary humanism allows us to see ourselves as an integrated part of the natural world, and to act accordingly.

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Endnotes:

1. Wilson, pp. 262-3.
2. Wilson, pp. 274-80; Mayr, *This Is Biology*, pp. 257-60.
3. Mayr, op. cit., p. 269.
4. Cited in Mayr, loc. cit., p. 269.
5. Ibid.
6. Ruse, pp. 94ff.
7. Wilson, p. 274; Mayr, op. cit., p. 249; Margulis, lecture.
8. Wilson, pp. 138ff; Hefner.
9. Mayr, op. cit., p. 269.
10. Wilson, p. 254; Mayr, op. cit., p. 268.
11. Wilson, p. 163.
12. Cited in Mayr, op. cit., p. 269.
13. Mayr, loc. cit.; emphasis added.
14. Drees, pp. 10-11.
15. Ibid., p. 21.
16. Margulis, op. cit.
17. Mayr, op. cit. pp. 255-56.
18. Ibid., p. 266.
19. Mayr, lecture.
20. Wilson, p. 262.
21. Ibid., p. 304.
22. Margulis, *Symbiotic Planet*, p. 2.
23. Ibid.
24. Margulis, lecture.
25. Ibid.
26. Mayr, loc. cit.
27. Wilson, p. 304.

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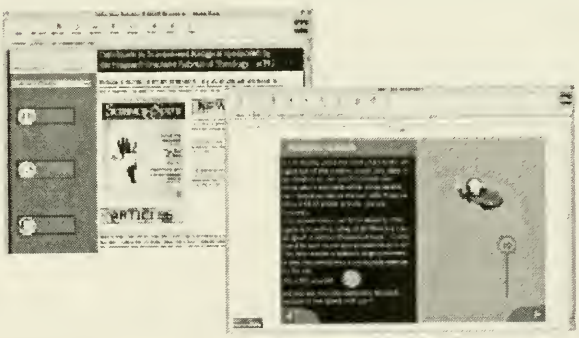
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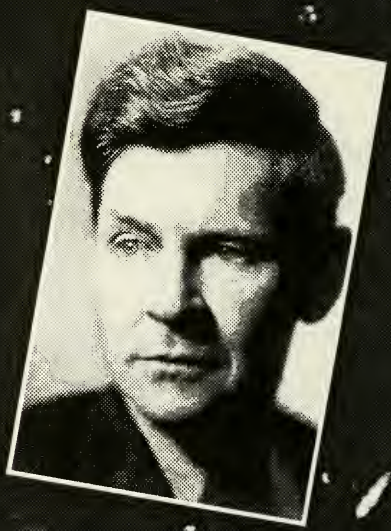


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